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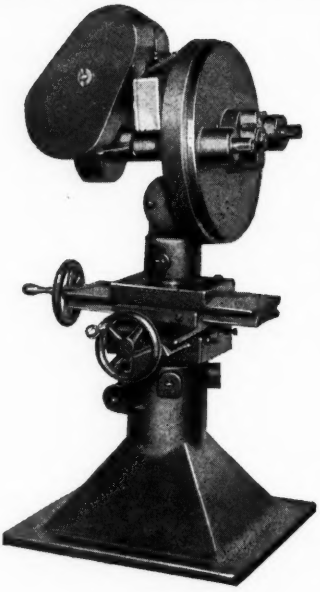

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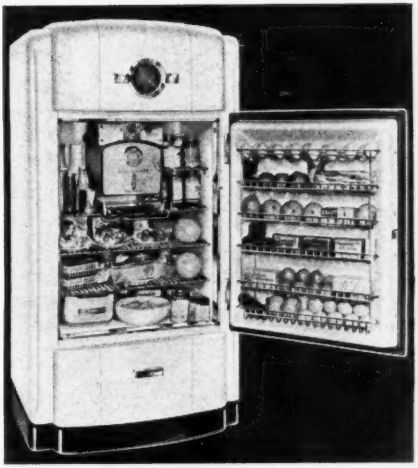
Finishing Shelvador Cabinets in New Crosley Plant



Latest Design of Equipment Is Combined With Efficient Layout in New Crosley Refrigerator Plant at Richmond, Ind.

By Fred W. Vogel

BUILT for the production of cabinets for Crosley "Shelvador" Refrigeration Units, the new Crosley plant in Richmond, Ind., is designed to obtain the maximum production from the most modern metal finishing equipment. The plant contains five and one-half acres of floor space, the larger part of which is devoted to finishing operations. Saw tooth roof construction provides maximum of daylight throughout the plant.

The production facilities are so coordinated as to make possible the production of 1200 finished units per day—enough refrigerators so that if a day's production were laid end to end, it would form a line more than a mile long. This article is devoted to an exposition of the methods and

Fig. 1—A view of the metal finishing department where the stampings are sanded before being Bonderized.

equipment used in the finishing of Shelvador cabinets.

The sixteen parts which go into the Crosley Shelvador cabinet are brought directly to the finishing department from the stamping department, which is located at one end of the new refrigerator building. Figure 1 shows workmen sanding the various panels in order to provide a smooth surface which will be free from imperfections and blemishes. Air-operated disc sanders are used in the sanding operation. The sanding machine is small and portable and can be manipulated with one hand if necessary, thus allowing the workman to have one hand free to hold the workpiece or tilt it at any angle for sanding inaccessible corners. Tools for removing dents that appear on the surface are supplied to the workmen on this operation. It has always been found a point of good practice to eliminate any imperfections at the very beginning of the finishing line, since it is in this way that a beautiful final finish can be assured.

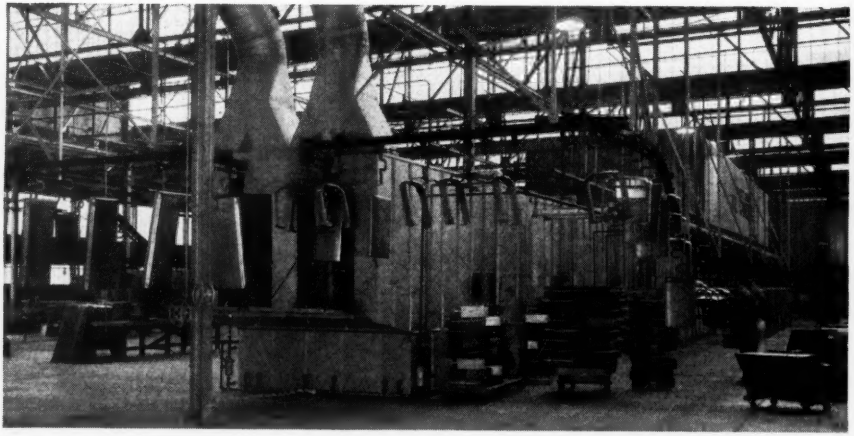


Fig. 2—Illustration showing the 150-ft. Young & Bertke Bonderizing unit. The workpieces are hung on the overhead conveyor shown in the foreground. Two such conveyor lines are accommodated in this unit.

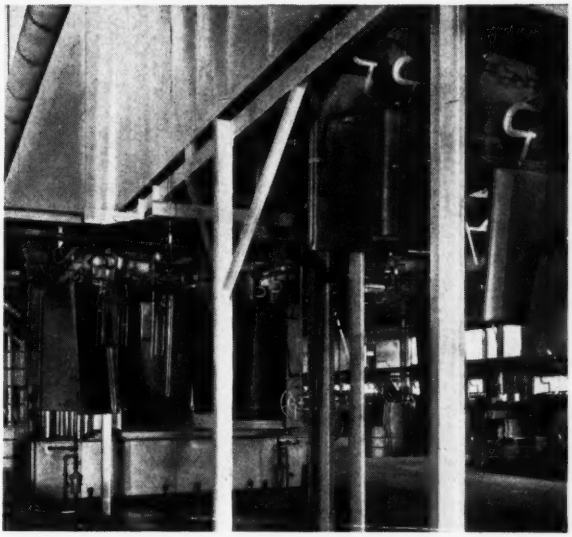


Fig. 3—A view showing exit end of Bonderizing unit with workpieces emerging from the chromic acid spray. Other workpieces can be seen descending from the drying oven located above the Bonderizing unit.

Adequate artificial lighting is provided in addition to the abundance of natural light which is afforded by the large skylights overhead. The item of adequate lighting is emphasized in the new Crosley plant with the result of better workmanship and less fatigue due to eyestrain.

After the cabinet stampings have been carefully sanded, they are transferred from the benches shown in Fig. 1 to the overhead monorail conveyor of the duplex Bonderizing unit shown in Fig. 2. This Bonderizing unit, which is approximately 150 ft. in length and consists of a series of six tanks, was designed and installed by the Young & Bertke Company, Cin-

Fig 4—The panels are transferred by hand from the Bonderizing unit conveyor to the spray booth conveyor. Each piece is carefully tack ragged before it is passed into the fully air conditioned spray booth department.

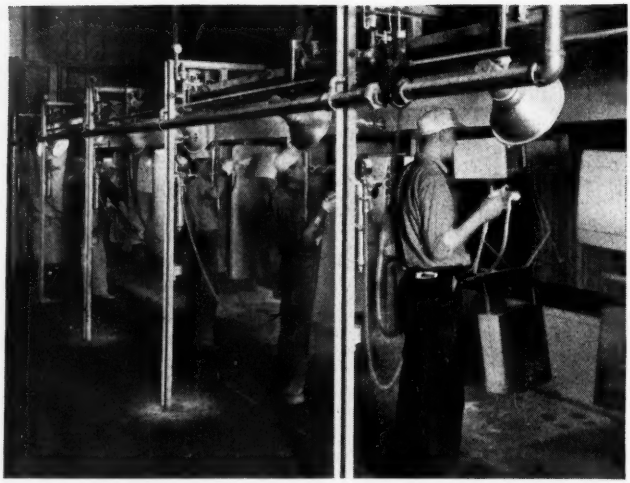


Fig. 5—A very clean spray booth is the result of carefully designed exhaust equipment and water wash spray booths. The workers in this department do not inhale any of the fine spray and their clothes do not become covered with enamel.

cinnati, Ohio. The unit is duplex in that it will accommodate two monorail conveyors of work at the same time. At peak production, the Bonderizing unit operates with maximum efficiency.

The Bonderizing process is a method of chemically producing an iron phosphate surface on the sheet steel parts. This treatment effectively retards corrosion should any moisture by chance penetrate a paint film due to mars or scratches in the home and provides a foothold for the paint, thus preventing flaking or peeling. When the finishing material is applied it flows into the interstices between the fine crystals of the etched surface and when dry, is securely anchored to the metal.

Tank No. 1 of the Bonderizing unit contains a hot neutral cleaning solution and has a capacity of 1,455 gallons. The tank referred to is a part of the continuous unit. Water is pumped from the tank into the vertical spray pipes and onto the workpieces as they pass through this part of the Bonderizing unit.

Following the hot water rinse, the workpieces are subjected to another hot water rinse. The tanks provided for this rinse contain 1,130 gallons and the spray pipes in the cabinet are located in the same position as in tank No. 1.

The Bonderite solution is kept in tank No. 4, the capacity of this tank being approximately 2,450 gallons. This Bonderizing solution is a concentrated compound, which when dissolved in hot water, forms a solution that reacts quickly to form a phosphate coating on the cleaned panels. The Bonderite coating is velvety in texture, opaque, and a neutral gray in color, and is adherently etched into the metal surface. When the workpieces are sprayed with the Bonderite solution, the Bonderite reacts on the metal surface. The reaction takes place with the evolution of hydrogen, continuing until the metal surface is completely converted to a crystalline phosphate coating.

The Bonderizing solution contains free phosphoric acid, metallic acid phosphates and an accelerator in the proper proportions to produce the phosphate coating in the shortest possible time.

After the workpieces have been subjected to the Bonderite solution, they are given a cold water rinse and then conveyed to tank No. 6. This

tank contains chromic acid and has a capacity of approximately 1,110 gallons.

Each tank of the Bonderizing unit is supplied with an individual motor pump for pumping the various liquids from the tanks into the spray pipes. A separate set of controls is provided for each motor pump, thus each pump operates as a separate unit and independent of the other pumps. The sturdy and dependable motors used to operate these pumps were supplied by Master Electric Company.

A 125 foot oven is provided for drying the workpieces after they pass through the chromic acid spray at the completion of the Bonderizing process. The oven is located directly above the Bonderizing unit, thus conserving a considerable amount of floor space. A view of the exit end of the oven is shown in Fig. 3. The panels on the conveyor shown in the lower and left portion of the illustration are emerging from the chromic acid spray tunnel of the Bonderizing unit and the panels shown at the upper right portion of the illustration are descending on an inclined conveyor from the drying oven located above the Bonderizing unit.

Shown at the right in illustration Fig. 4 is the unloading end of the Bonderizing unit conveyor. Workmen transfer the workpieces from this conveyor to the spray booth conveyor shown at the left of Fig. 4. Each piece is carefully wiped with tack rags which are approximately 18 in. by 36 in. in size and come individually packed in wax envelopes. The purpose of the tack rags is to remove any dust or foreign matter which would leave objectionable spots in the final finishing. Tack rags provide the means for obtaining a dust-free, clean surface.

After each workpiece has been carefully wiped, it is ready for the enameling department. A view of several spray gun operators spraying panels with the ground coat in a DeVilbiss water-wash spray booth is shown in

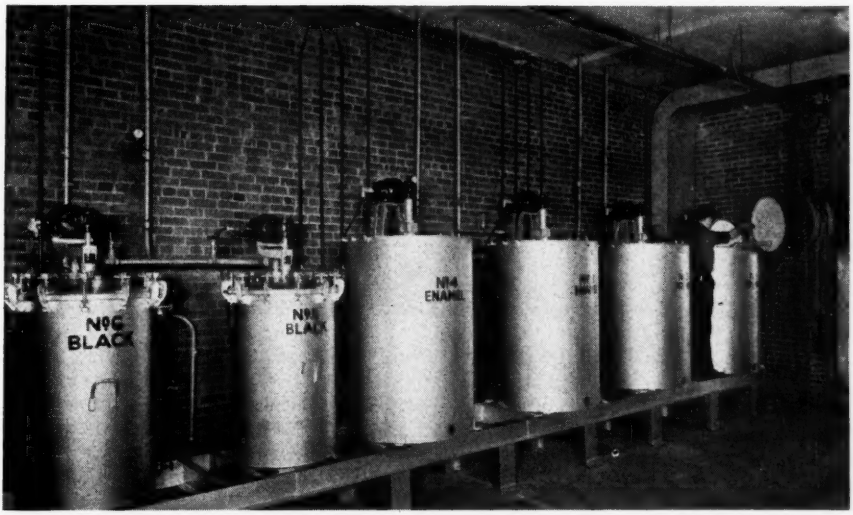


Fig. 6—The enamel used on the Crosley Shelvador cabinet is stored in large tanks, each of which is equipped with a mixer that insures a uniform coating.

illustration Fig. 5. This spray booth is one of the two water-wash spray units located in the fully enclosed air conditioned enameling department. The conditioned air enters the spraying department through a large center duct located overhead. The currents of air sweep downward and into the openings or vents at the base of the spray booths, thus forcing all spray toward the water screen located through the water trough.

Adequate lighting is provided each spray gun operator through several explosion-proof lighting units that are adjustable to any angle. The absence of any supply tanks is readily noticeable in the spraying department. The enamels are kept in an isolated storage room that is completely air conditioned.

A view of the storage room is

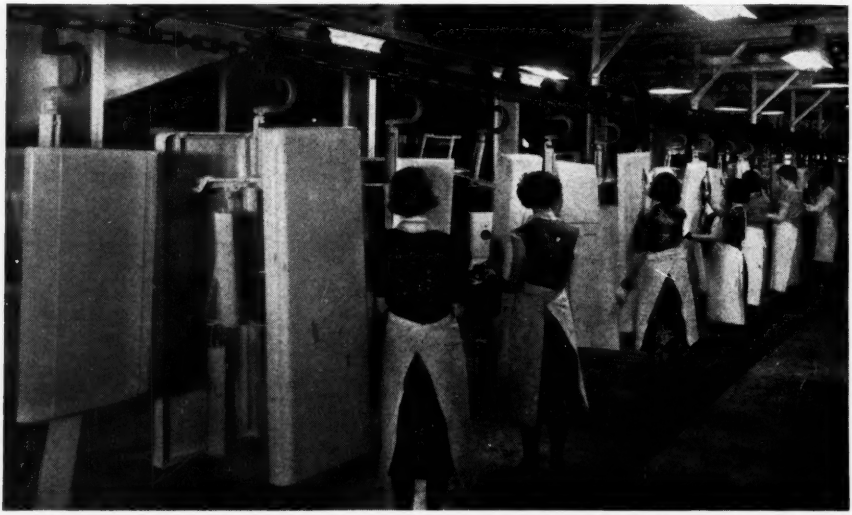


Fig. 7—The primer enamel coat is carefully sanded before a second coating is applied. Each piece is then carefully tack ragged to remove dust and other foreign material.

at the rear of each booth. Practically all excess spray is carried into the water trough, from which place it can easily be removed. The capacity of the two DeVilbiss water-wash spray booths is 3,200 gallons each.

In operating the spray booths according to the water-wash principle, the tank is filled to the proper level for initial starting and water wash compound is added. The compound prevents excessive foaming from agitation caused by air currents passing

shown in Fig. 6. Each numbered tank is equipped with an agitating unit that keeps the contents thoroughly mixed at all times. In the illustration, a workman is shown emptying a drum of primer coating into the storage tank. This task is performed easily and quickly with the aid of the overhead monorail conveyor hoist. You will note the cleanliness of this storage room. From the storage tanks, the various coatings are piped to the spraying department, by

Fig. 8—As the finished pieces come from the enamel baking oven, they are inspected before being passed to the assembly department. Note carefully that an abundance of light is supplied to the inspectors.

means of individual pumps which work automatically with the requirements of the spraying department.

Immediately following the application of a ground coat, the panels are conveyed to an overhead drying oven where the ground coat is thoroughly dried. The pieces pass three times through the oven, which is approximately 105 feet in length. The oven is equipped with a J. O. Ross heating unit, thus the maximum production of thoroughly baked coats is assured.

Figure 7 shows workers sanding the ground coat. The sanding is light and is required to prepare the surface for the enamel coat. Tack rags are again used to remove dust as a final preparation for the enamel coating and the workpieces are again conveyed into the finishing department where the final finish is applied. The final finish is baked on in an overhead oven, the exit end of which is shown in Fig. 8. Skillful inspectors carefully examine each piece as it passes beneath a battery of Cooper-Hewitt mercury vapor lamps, thus making sure that each cabinet is free from blemishes.

The sixteen pieces which comprise a cabinet require two racks for transportation; thus each adjacent pair of hangers carries the parts for a complete cabinet. The pieces are thus racked so that as the parts reach the assembly line there will be no delay in the assembling operation.

A view of the final assembly line is shown in Fig. 9. At this point the cabinet is completely assembled and the refrigerating unit installed.

"Transactions of the American Foundrymen's Association." This is the title of Volume No. 45 which includes papers and committee reports presented at the 1937 convention of the American Foundrymen's Association, Milwaukee, Wis., and is being published by the A.F.A., 222 W. Adams St., Chicago, Illinois. Included in the contents are papers de-

Fig. 9—A view of the final assembly line. The cabinets are here assembled and the refrigerating unit installed.

voted to the various phases and practices in the different branches of the foundry industry; namely, gray iron, malleable iron, steel and non-ferrous castings.

The papers of interest to gray iron foundrymen are those on wear testing, cupola high test cast iron, the effect of coke size on cast iron, the occurrence and control of ferrite in cast iron, a summarization of the information available on graphitization and inclusions in gray iron, the effect and composition and section size of plain cast iron, microstructure and physical properties of alloy cast iron, and cost methods used in gray iron foundries.

The malleable division of the industry is represented by papers on heat treatment of malleable irons, selection of cycle and the type of furnace for annealing, sand control in malleable foundries, melting developments and cost methods.

The steel division will find papers on construction stresses, test coupons, heat treatment, sand control, methods of producing steel for castings, of interest.

Non-ferrous foundrymen will be interested in papers on sand control, the production of pressure-tight 30 per cent cupro-nickel castings, a discussion of problems in the manufacture of bronze castings, and non-ferrous foundry cost methods.

In addition, there are many papers of general interest such as those on refractories, radiography, and so on.

The rear of the book contains a ten page cross index of the material contained together with an author's index. Illustrations and tables are used generously throughout the book in the various papers to bring to the reader a clear understanding of the various subjects under discussion and for the correlation of information. The price of this book in red cloth binding is $10.00.

Natural Laws Applied to Production. This book, containing 32 pages 8½x11 in. in size, comprises a history of the development of the modern factory and shows how, by working together as a group in an efficient manner instead of singly, a given number of men can increase their productive efficiency in direct ratio to the size of the group. The book contains eight chapters as follows: 1—Facts vs. Principle. 2—The Law of Least Action. 3—Functional Sequence. 4—The Laws of Production. 5—The Laws of Materials Handling. 6—The Function of Management. 7—"From Here On." 8—Basic Elements of a Conveyer System.

In addition to these eight chapters, the book presents diagrams to illustrate the various types of conveyors and their relation to movement, together with several pages of illustrations showing the different kinds and types of conveyors used for handling a wide variety of materials through the sequences of manufacturing operations. The book should be of prime interest to anyone who is concerned with the modernization of manufacturing methods. Copy free to any mechanical executive upon application to Mathews Conveyer Company, Ellwood City, Pennsylvania.

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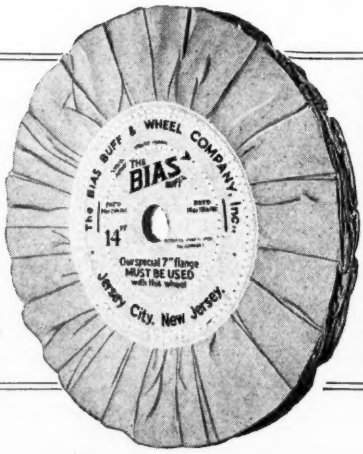

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Cold Rolled Steel For Plating Purposes

By Frederick Fulforth

The Proctor Electric Company, Philadelphia, Pennsylvania

IN THE writer's opinion and in contacts as consultant to various firms manufacturing a wide variety of products, one of the ever-recurring problems in obtaining the two extremes of low cost and fine plated finish on steel stampings, can be traced to improper specifications or to improper press shop methods.

These are not the only causes for inferior finish, it must be understood, but it is surprising how frequently one or the other crops up as a reason to improperly and unjustly place blame for poor quality finish on entirely different elements than those truly offending.

Probably the reason for this is due to the fact that all plating and other manufacturing processes are directly under the control of the manufacturer while he has neither the knowledge of steel manufacturing conditions, nor if he did have, would he be in a position to enforce his demands from the rolling mill for better quality unless tonnage were a consideration and therefore brings unreasonable pressure on his shop force without realizing he is doing so and obtains no better results in the end.

Again, the newer cost saving methods for plating and handling are not generally known in spite of the efforts made by some firms and individuals as well as technical society education of its membership. The trouble here seems to be that steel for fine plating purposes is such a small portion of the total tonnage rolled, that very few mills have either made an effort to supply the kind essential for platers, or conducted any specific research into what the plater needs unless it might be for such large production as that used by radio, refrigerator and automobile manufacturers where rust-proofing is the main consideration rather than plated appearance.

To give the rolling mills their credit due, however, it is only fair to say that several years ago it would have been impossible to do with cold rolled strip steel those things which the plater is doing today. As an example, some seven years earlier the writer had experience with a formed operation upon which it was necessary to perform fourteen cents' worth of polishing in order to bring the surface of the piece around its bent edges back to a condition where they could be satisfactorily plated and even then only by the application of heavy buffed acid copper and nickel coats could the surface imperfections be partially covered, while the percentage of rejects was ruinous. Naturally, some of this was due to improper part and die design but even had these been of the best, the steel would not have made the job as the purchaser would like to see it.

Such vast forward strides have been made by the rolling mills that

it is now possible to consistently procure cold rolled strip steel which is of such a specification that no polishing is required previous to plating even when considerable cold working is necessary in the manufacture of the part; and there is no reason why all concerned should not know this and understand how to order steel for the utilization of these advantages.

For those who feel they have to order steel on a price-per-pound basis and are unwilling to pay more per pound to lower the cost per finished piece, this paper will have no further interest, but for the open-minded or those willing to at least discuss the subject, the following paragraphs will try to convince of the possibilities for cheaper and better finish when complete knowledge of specifications is available.

As a sample of the nature of work under discussion, visualize a round flanged lid about seven and one-half inches in diameter with a one-half inch flange at right angles to the top made from 0.037-in. cold rolled strip steel and weighing approximately one pound with scrap losses. If cheap cold rolled strip is used for this purpose, at present day prices, the cost per pound and therefore of one piece, for material alone will be between three and one-half to four cents.

The press operations required to make such a piece would be as follows:

1. Combination blank and form.
2. Trim.
3. Punch any required holes.

From actual records, the press shop operation for this piece would cost six dollars per thousand for direct labor were no automatic press feeds used, or six tenths cents each.

Immediately upon completing the forming operations, troubles may be expected, since with this type of steel it is too much to expect a uniform hardness and it may have buckles, dents and even breaks, and while there was no extra money paid for grain size, even if one is sufficiently fortunate to procure a hardness within drawing range for the whole lot, there will be plenty of eggshell on the radii and orange peel effect down the sides. This all means additional inspection to avoid further work on pieces

Sample #303 - Heat 401158

Analysis of Heat:

C	Mn	P	S	Si
.12	.39	.010	.032	

Analysis of Sample:

.14	.43	.009	.039	.001

Micrograph 100 X

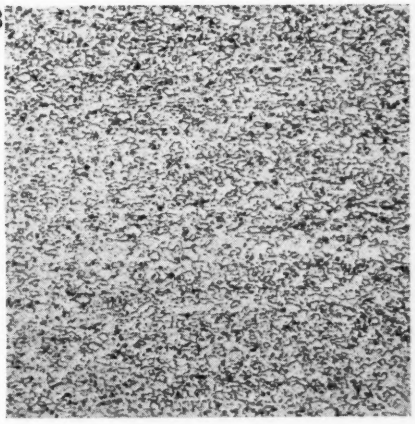


Fig. 1—An analysis of a steel of the type known as a 12 carbon heat. A microphotograph of the sample analyzed is also shown herewith. Magnification is 100 X.

which could be of no value when finished and will also require that each piece be polished all over to remove the aforementioned orange peel effect and the handling scratches produced by using unprotected stock all along the line. The polishing cost will amount to about three cents each on direct labor on a basis designed to pay the polisher at the rate of one dollar an hour, even though the article being round is handled on a spinner made for the purpose.

From recent information derived from the exposure tests under the direction of the Bureau of Standards, the facts are fairly well established that a single coat is equally as good for corrosion protection as double coats of equal thickness, consequently nickel will be the only plate considered prior to chrome for the purpose.

Securing a sufficient thickness to give the buffer an opportunity to flow over all defects would require a deposition closely approaching a minimum of 0.001-in. and should still leave enough after buffing to give good protection by which is meant approximately .00075 in. thickness or at least twenty-four to thirty-six hours in the salt spray test. The advocates of copper nickel will find upon investigation that the cost of applying and buffing the two coats will run above that of a single thickness of nickel but all plating being conducted under such widely variant conditions, no attempt will be made here to establish a definite cost and in any event, whether poor or good quality steel is used, or whether one or two buffed coats are applied, the plating procedure should be about the same so that the cost comparison would be very slightly affected. The piecework price paid to nickel buff this part so that all major defects are covered will be about one and one-half cents based on buffers' earnings of one dollar per hour.

So much for the story of cheap steel and in recapitulating we have, for a total material and direct labor cost when plating is eliminated, the following:

Material	$.035
Press operations	.006
Polishing	.030
Buffing	.015
Total	$.086

Instead of buying three and one-half to four cent stock, suppose the best quality cold rolled strip steel procurable to your specifications were ordered and received properly boxed, papered and inspected.

The actual cost of such steel is in the neighborhood of six and one-quarter cents per pound and since the article under consideration weighs one pound, its material cost would be $.0625 which is $.0275 higher than the same article made from cheaper grade stock.

Instead of rushing through the press shop operations, assume them to be handled a little more slowly and carefully and more time spent on the dies to eliminate die marks, slug impressions and handling scratches all of which are facilitated by the method of boxing and packing the stock. This will raise the cost from six to eight dollars a thousand pieces or eight-tenths of a cent each.

Now by doing these two things, the polishing may be entirely eliminated and the cost of buffing reduced from one and one-half cents to one cent, since there being fewer surface defects about the only work required is a coloring operation on the nickel.

Moreover, although it will not be included in the cost figures for reasons previously stated, it is evident that less nickel may be used for equal protection since the buffer no longer has to remove so much before covering defects and a substantial saving may be made on the weight of nickel applied, the time required to attach it and the overhead which is always

heavy in all plating operations.

Under these conditions, we now have a comparative cost which is somewhat as follows:

Material	$.0625
Polishing	None
Press operations	.0080
Buffing	.0100
Total	$.0805

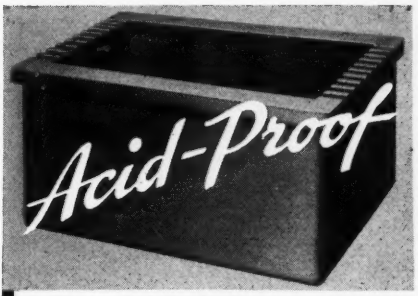
as against $.086 for cheap steel, indicating a direct saving of $.0055 per piece and not including the saving of nickel as metal and its plating time.

The direct saving can thus be readily shown but the intangible savings, although present, are difficult to estimate in dollars and cents. Such things as lessened inspection requirements, fewer rejects, greater sales and eye-appeal due to improved finish, greater production per operator with a correspondingly smaller overhead and the increased perception of the workers toward their product and their natural pride in turning out a good job, are financially incalculable but very real items for consideration.

The foregoing is based on an actual conservative case and is largely supported by purchasing steel from rolling mills willing to supply it according to the following six requirements which are explained as given.

The first requirement is the finish and this should be specified as No. 3 cold rolled strip steel of proper gauge, width and in multiples of the length required to make one piece.

The No. 3 means to the mill a surface finish free from handling marks, scratches, rolled shear edges, dents, dirt and in short anything which would tend to require a polishing operation to remove a blemish of any kind and most important of all, a certain degree of brightness which is better for plating than any other finish short of buffing with stainless steel compound.



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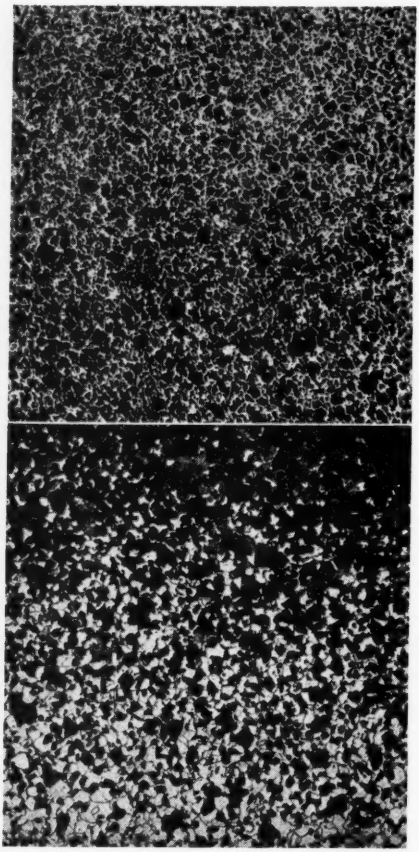

Fig. 2—Two illustrations of the A.S.T.M. Standard Grain Size Chart showing specimens that have 96 or more grains per square inch at 100 magnifications. *(Photo courtesy American Society for Testing Materials)*

The multiple of the length of one piece although an extra, will more than pay for itself in scrap savings and the obviation of rehandling to shear with its consequent accummulation of scratches and imperfections.

The second requirement is oiling. Specify the use of an oil or grease preferably of lanolin base or any other composition which will not dry out or shrink during storage. If the proper type is used, no further lubrication will be required for the usual blanking, forming, punching and bending press operations, another small saving on lubricants.

Some of the slushing compounds used by rolling mills when not otherwise specified are practically impossible to remove without special cleaning equipment and in long storage have a tendency to dry out and shrink leaving exposed areas of steel, which in a moist atmosphere will rust, ruining any potential saving otherwise possible by polishing elimination.

The third requirement is papering. Each sheet must be separated by a special sulphate type paper, free from chemicals tending to attack the steel or solid impurities embedded by paper manufacture which might mar or scratch, through the constant shifting of sheet on sheet in transportation.

This paper is retained in intimate contact with the steel sheet throughout blanking, punching, bending, embossing and some drawing operations in the presses and more than pays for its extra cost in the saving of handling scratches and die marks eliminated by its use.

It must not be so porous as to absorb the oil on the surface of the sheet thereby allowing rust spots to develop nor so impervious that sufficient oil will not penetrate to cause adherence to the oily stock surface which latter condition if not properly carried out would allow the paper to wrinkle and fold and not lie flat and smooth, which condition would cause a mark to appear in the steel everywhere pressure was applied over one of the irregularities.

For obvious protective reasons, the paper must be the exact size of the steel, neither overhanging its sides or ends nor being narrower or shorter than the strip itself.

The fourth requirement is boxing.

The strips must be boxed in convenient handling weights not to exceed say 500 pounds and held therein so that no detrimental motion can occur in handling or shipment. These boxes must be metal strip bound and nailed securely and be of sufficient thickness (approximately ¾ in.) to withstand all reasonable handling without breakage.

The gauge width and length of stock and the net and tare weights must be plainly stenciled on top along with a notation saying, "best side up", which packing must be satisfactorily insured by the rolling mill's shipping inspector. Also, the net weight should be plainly stenciled on one end of the box so that when piled, the total weight of the lot may be readily computed by adding the stenciled end weights without the necessity of moving all but the top box to read them.

In use, only the top box should be opened for withdrawal of stock and each box should be kept with the "best side up" notation to the top and all pieces removed, handled so that this side will be covered by the paper strip and eventually become the outside of the finished article.

Boxes should be renailed when withdrawals have been made so that no shop dirt or moisture can penetrate the paper and cause trouble later.

The fifth requirement is tempering. This is best determined by agreement with the mill after a sample piece or drawings have been submitted to them, but from the writer's experience a "B" Rockwell of 45 to 55 will care for all ordinary press operations satisfactorily. The greater the hardness it is possible to achieve, however, the better will be the final finish but care must be exercised that no wrinkling or upheavals take place in drawing or bending operations if the stock becomes too hard.

Here again an allowance must be made for age-hardening which will increase the "B" Rockwell reading as much as five points, depending upon the time stored and the weight imposed upon each sheet in storage.

One example occurred in which a steel purchased in 1935 was ideal for the work performed upon it but in 1937 the age-hardening had carried the hardness just beyond the end point and the whole lot blanked and punched therefrom was useless when

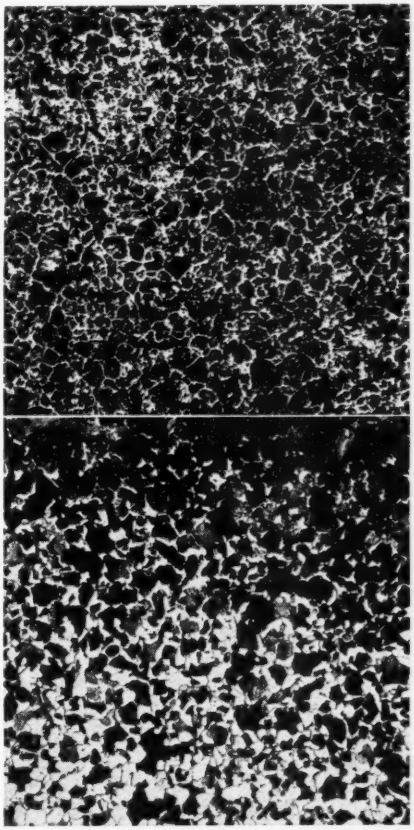

Fig. 3—Two illustrations of the A.S.T.M. Standard Grain Size Chart showing specimens that have 48 to 96 grains per square inch at 100 magnifications. *(Photo courtesy American Society for Testing Materials)*

the drawing operation was reached, necessitating a very greatly increased cost to finish to specification.

These steels are all of the type known as a 12 carbon heat, while analyses and micro-photographs of typical heats are printed herewith.

In general, the closer it is possible to work to Rockwell B48, the better the finish and a reasonable safety factor is allowed by this hardness.

The sixth and final requirement is grain size. This subject seems to be but little understood by either the rolling mill or the manufacturer in relation to the final finish required, but it is one of the most important, if not the one of highest importance and requires very careful specifications to insure success.

In 1933 there was adopted a standard grain size chart by the A. S. T. M. which is available to anyone wishing a copy, through that organization and two examples of their No. 8 micro-photographs are illustrated in Figure 3, which arbitrarily means that 96 or more grains per square inch are present at 100 magnifications, the best for formed or shallow drawn parts while the A. S. T. M. No. 7, as shown in Figure 2, 48 to 96 grains per square inch at 100 magnifications is better suited to medium deep drawn work.

Although the chart stops at No. 8, by comparison with the sample in Figure 1, it will be seen that the texture here is much finer than the standard and for the purpose of fine plated finish on formed or shallow drawn parts is far preferable to a coarser grain. Few mills are in a position to supply this grain size consistently so that if exceptionally fine grain is desired it should be so specified when placing the order.

Grain size is entirely controlled by the rolling mill all the way from their purchase selection of billets and the amount cut or cropped from them before rolling, down to the final development of their heat treatments between passes and is a very critical, difficult process to regulate.

If all the specifications above are properly cared for it is possible to produce a beautifully bright plated finish on steel without recourse to polishing and to entirely eliminate any sign of orange peel or egg shell on medium shallow draws and forms.

Finally, if it is decided to go in for this type of steel it is wise to procure samples large enough to process through the dies to be used for the work before ordering and after receipt of the production lot to make the first run from various boxes all through the operations to determine degrees of uniformity previous to final acceptance.

No amount of good steel can be profitably processed without the correct methods of production but the scope of this paper limits a discussion of procedure along these lines which is another story in itself.

It would be ungrateful to close this writing without giving full credit to Mr. George B. Hogaboom for his original arousing of enthusiasm in the writer toward solving some of the reasons for plated steel failure, and to Mr. George B. Whitehead, Superintendent of the Proctor Electric Company, the immediate superior whose patience and invaluable suggestions have done much to secure rolling mill cooperation, as well as to Mr. Otto C. Gross, Research Engineer of the Greer Steel Company, by whose courtesy the accompanying analyses and micro-photographs are reproduced.

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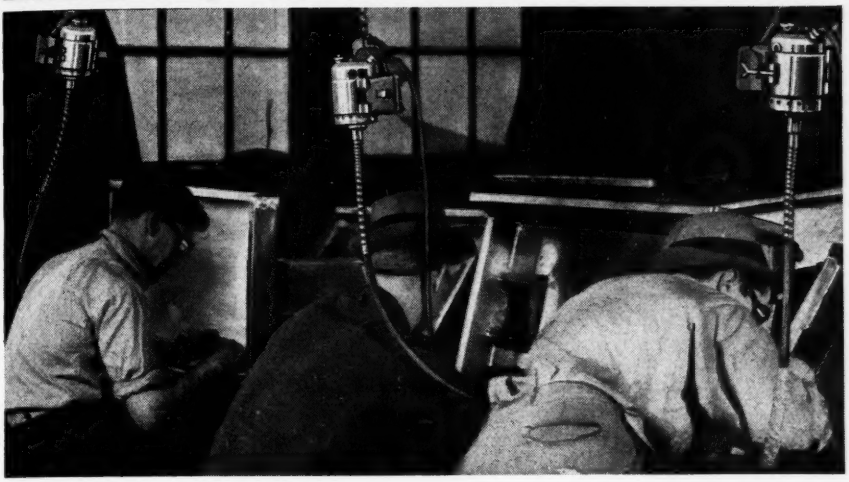

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Porcelain Enameling Experiences and Developments in Australia and United States, Part II

By Fred M. Burt

THE foregoing installment mentioned the application of a new type of furnace and fork, and in addition there was a problem of fully modernizing four other units. The units had all started as coal-fired jobs and were set with the back ends about fifteen feet from an outside wall which meant fifteen feet of inside operating space virtually lost.

A new layout was made, allotting exactly the proper amount of space to each furnace in a new location and each was set back fifteen feet. In the meantime, an additional 100 ft. x 200 ft. was gained by moving a complete aluminum kitchenware department into a new building. The 100 ft. dimension was an extension of the furnace line. The increased space permitted the rebuilding of four furnaces and two new ones, all in a row. Fig. 1 shows No. 3 furnace as it appeared before rebuilding and conversion from a Carboradiant type to the full muffle. This was the largest furnace with a burning area 6 ft. 6 in. wide, 12 ft. long and 4 ft. high.

The No. 3 furnace was uninsulated and was equipped with two rear burners, one an American burner, in the carboradiant chambers and a front booster burner firing underneath the carbofrax hearth. This furnace consumed 18 gallons of fuel oil hourly. With a new Carbofrax hearth on Carbofrax piers and a full muffle of thin section Sillimanite (Kyanite) of Australian manufacture the number of gallons of fuel oil consumed was cut to 12 gallons. The door was a cast iron frame, sheet metal front, and 13½ in. fire brick lining weighing about 1500 lbs. American refractory insulator brick was imported (Massillon, O. Refractories Co. R-1 43) and used to line a steel frame, which was to be used as a door. The nine inch door eliminated most of the heat loss and cut the weight in two. The fork shown in the illustration was built after an American design but improperly balanced and required two and three men to raise for charging the furnace, when loaded, even after the raising lever was lengthened. In consequence, new forks were built of the double charging type after the latest American design, with compressed air lift.

This type of furnace was used almost entirely for flat work, signs and stove parts, and had for tooling, sets of mild steel six inch pins set in ⅜ in. by 1¼ in. parallel bars. As the pins scaled off and became dull very quickly, no attention was paid to sharpening same. They were straightened occasionally and soon wore out. To replace these, a very satisfactory special alloy metal was found, an Austrian product, called POLDI steel,

of the proper nickel-nichrome content. Over $2,000 was spent, mostly for ⅜ in. round, which was cut to 5 inch lengths and pointed with an inch long, gradually-tapering, point; and for ⅜ in. by 1¼ in. and 1½ in. bar which was cut into lengths six inches less than the width of the furnace. These were made into tooling with the bars made of two lengths, parallel, and joined 6 in. or 8 in. apart. The pins were then welded into holes bored in the bars 3, 4, and 6 inches apart to accommodate various size ware.

A reconditioning bench was made with vises, anvil, and a 17,000 r.p.m. light (1¾ lb.) compressed air grinder using conical Carborundum grinding wheels. By clamping these pin bars in two vises with the points on a horizontal plane pointed towards the operator, the conical grinding wheel could be made to slide around and sharpen a pin in five seconds.

This tooling was a vast improvement, since the points would stay very sharp for a week to ten days of 24 hour daily operation, even though the points were subjected at regular intervals to a coating of a mixture of English Ball clay and water on a brush. It was heavier than necessary, and every extra pound of tooling increases fuel consumption and lengthens burning time. This situation happens to be a very common enameling factory fault. When special non-scaling, non-warping alloy metals came into use for tooling, the common practice was to use the same sizes as were formerly used with mild steel. And the practice is still common and worse yet, heavier cast alloy tooling is used where rolled material of half the weight, or less, would be sufficiently strong. The racks may warp more quickly, it is true, but the time required in straightening is much more than offset by the advantages coming from reduced furnace load weights.

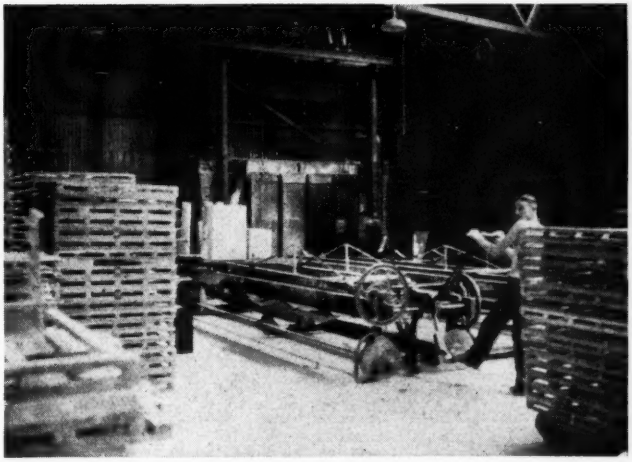

Fig. 1—Illustration showing furnace as it appeared before rebuilding and conversion from carboradiant type to the full muffle.

Therefore in designing furnace tooling, the very lightest weight that can possibly be used should be worked out by careful experimentation. And therein lies another argument for the furnace design mentioned in the first installment.

Each furnace and smelter at Metters Ltd. was equipped with an American burner bought in 1927. None that were made then is up-to-date now so a search was made for a better one. Just before it seemed necessary to import modern American burners the writer learned of the Melbourne made "Major" burner. This type of burner is wonderfully efficient, producing a

perfectly proportioned mixture of atomized oil and air, and controlled (in temperatures under 1900 F.) by a thermostat remarkably close to pyrometer controller performance. While it was planned to use a pyrometer controller at a later date, six furnaces and four smelters were hooked on to one pyrometer with ten points of setting and two calibrations. The control man and night foremen checked all units in use periodically.

Fig. 2—A view of the left side of the pickle room looking from the front end. Brushing tables are conveniently located in the center foreground.

All of these furnaces and smelters were hooked to one very large and tall central stack by underground ducts with the theory that a considerable draft was needed for good combustion. In fact, it was but a boon to the oil companies. The same holds true in many American enameling plants. A proper oil (or gas) burner on a well-designed enameling furnace needs only an outlet for the products of combustion. A refractory stack four feet above the furnace (or smelter) and a steel stack from there through the roof a few feet is sufficient. There should be a refractory or heavy metal damper on a horizontal plane inserted on top of the refractory stack. If there is any flame of consequence beyond this damper, the combustion is improperly controlled or the furnace is wrongly constructed. The burner and furnace construction changes reduced average fuel consumption on full, double speed fork production to 10 gal. per hour in a 5 ft. by 12 ft. furnace, from 14 gal. per hour on a 4½ ft. x 10 ft. furnace with single fork production. With oil at 4d (four pence) per gallon, this represented a saving of $6.40 per day per furnace at the present rate of exchange.

These figures are given in detail for the simple reason that this company was satisfied with the old fuel consumptions and in comparison with competitor's furnaces, it was low. The same situation applies in many American enameling plants, particularly where natural gas is available at low rates. The idea prevails that no saving of consequence can be made whereas the facts in the case are often not known fully and completely. This is well illustrated in a recent experience of the writer's in an enameling factory where he designed new smelters and furnaces. 1100 b.t.u. natural gas at nine pounds pressure costing 16 2/3 cents per 1,000 cu. ft. was used. This was a bath tub furnace operating at an average of 1700 deg. F. The average hourly fuel consumption over several weeks was 2464 cu. ft., 41 cents per hour, $9.84 daily. This is a very low rate when it is

considered that the greatest volume of gas used in the porcelain enameling industry costs from 45 cents up, with some users paying as much as 65 cents for 540 b.t.u. manufactured gas. Therefore, in this plant it was not thought that any worthwhile savings could be effected. Casual thought only, was applied to the problem, but the actual facts are illuminating. The furnace hearth was of four inch fireclay tile on piers under 45 per cent of the hearth. This required a temperature of from 2500 to 2700 deg. F. in the two burner combustion chamber to give 1700 deg. F. just four inches higher. There was no control of the admission of secondary air for combustion, no insulation, and a 36 in. flue in a 40 ft. stack.

Allowing an original cost of $3500 for the furnace and $350 per year for maintenance, in seven years a total of $5,950 is realized. Fuel consumption in seven years, 250—24 hour operating days at 41 cents per hour amounts to $17,220.00. This furnace could have been built for $4500 to have a better production capacity, with exact pyrometric control, fully adequate heat at all times, no greater maintenance cost and about 1/3 as often in repair shutdowns. It would have operated with about 1900-2000 deg. F. heat in the combustion chamber, on 1500 cu. ft. per hour, or a fuel bill of $10,500 against $17,220. A net of $5,720, or $817.00 per year. The resulting difference is more than the price of a new furnace and all equipment. Figures like this are worth considerable thought and research. It had been taken for granted that because the fuel was so cheap, any possible savings would not be worthwhile. With all the information easily available from more than one source, to build enameling furnaces and smelters that are known to be absolutely the best for the specific job to be done, it is hard to find a reason that this

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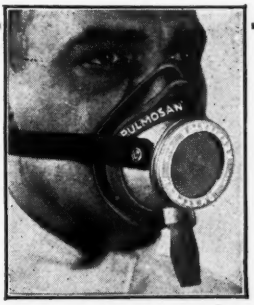

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information is not obtained and used.

Having attempted to read everything published about porcelain enameling, the writer makes bold to state that there is no enameling factory executive who is too busy to read everything published in trade publications and in books on this subject. An intelligent use of this information would either point out in exact detail the best practice, equipment, material, performance or show where this information can be obtained easily and inexpensively.

While these activities were going on in the Sydney plant, a disastrous condition arose in the sheet iron department of the Melbourne branch where there were three oil-fired furnaces in operation. The ground upon which the plant was built was previously somewhat of a swamp and still very moist. The heat from the combustion chamber dried out the soil under the furnaces so that they dropped a few inches at the corners, cracking the muffles and side walls and throwing the tooling rests off level. As a temporary expedient before new furnaces could be completed, these furnaces were plugged and straightened up as much as possible and water pipes laid in trenches on each side several feet below floor level. These fed constant small quantities of water to re-moisten the dried out and shrinking clay soil.

In order to make it absolutely impossible for such trouble to reoccur with new furnaces it was decided to build electric units. For a foundation, a two foot excavation was made, and then a few inches of sand and a concrete raft 20 ft. x 15 ft. was made and reinforced by 4 six inch I beams running the long way and 3 six inch I beams across them the other way. On top of the raft, the furnace was built on still heavier I beams running the long way of the furnace. These beams left an air space under the furnace which also had bottom insulation. Nothing was left to chance and with this construction the foundation soil was subjected to no heat.

One of the first changes made in the Metters plant was in enamels. Following are the chief sheet iron formulas used as installed by the writer, and which made wares that competed with and surpassed the best importations. These formulas are tried and

Sheet Iron Porcelain, Enamel Formulas.
Ground Coat, Blue Mottle, and 2 Sign Blues.

Chemical	B-34	B-37	B-36	B-39	B-B-D	B-80	B-82
Feldspar	31.00	20.40	28.00	27.20	23.00	25.67	23.90
Silica	18.94	24.40	19.00	15.20	20.20	22.33	17.50
Fluorspar	6.67	4.90	5.00	4.10	5.00	5.33	4.80
Borax	28.40	37.42	30.00	41.50	39.40	27.67	28.70
Soda Ash	6.08	6.60	8.00	4.40	5.00	7.33	8.00
Nitrate Soda	4.73	3.68	4.00	3.70	3.63	4.33	4.80
Cobalt	.75	.75	.75	.....	2.02	1.65 (6)	4.80
Manganese Dioxide	3.44	1.60	1.75	1.33	1.40	1.00	1.00
Black Nickel Ox.	.....	.50	.50	1.17	.....	.....	.....
Cryolite	.....	.....	3.00	.....	.....	4.33	3.10
Calkspar	.....	.....	.....	.90		Zinc Oxide	3.10
Red Oxide of Iron				3 oz.			
Magnesium Carbonate					.30		
Black Oxide of Iron						.50	
Black Copper Oxide							.30
	100.01	100.25	100.00	99.50	99.95	100.14	100.00

sufficiently fool proof that they can be used in any plant by following a normally good smelting, milling, and setting-up practice.

No special instructions on smelting these enamels other than that they should be smelted at between 2100 and 2200 deg. F. Regular careful mixing and smelting practice, with the standard time and temperature was established and adhered to.

B-34 is a fairly hard ground coat, B-37 softer. For a wide variety of work (especially refrigerator linings and so on) a very good combination is to mill B-34 — 70 lbs., B-37 — 30 lbs., English Ball Clay (or other) 7 lbs., Borax 1 lb., Water 40 lbs. If there is a bad rust condition add ½ lb. Soda Ash. B-34 will stand hard and high firing and is very good for muti-fired sign work and difficult kitchenware conditions.

B-36 is a close approximation of the relative softness and hardness of the above 70-30 combination.

Use 7 per cent clay for dipping or for dipping and spraying out of the same batch, and 4 per cent for spraying only.

B-39 is an inexpensive enamel (due to lack of Cobalt) and is used on kitchenware to make a colored ground, one coat job. It comes from the smelter with a brownish tinge. It must be very thoroughly smelted and stirred often. For a greenish single coat mill with 7 per cent clay, 40 per cent water, 1 per cent Borax, 3½ per cent Cobalt Chromate Green Oxide. For a Brown, use 2½ per cent of a rich dark brown oxide.

A superior black enamel for black edging kitchenware cover coat over ground coat, for beading, or signs, use the 70-30, B-34 and B-37 combination or other relative combinations

Fig. 3—Front view of dryer. The semi-circular metal tanks shown in the foreground are dipping tanks. The work-pieces are dipped into these tanks before being passed into the dryer.

to get other desired hardnesses with the same mill addition plus 3 per cent black oxide (such as Vitro's No. 200) if strong enough. Some oxides would require 5 per cent addition. Any of the other ground coats can be made into black the same way.

The B-B-D enamel is a single coat enamel for making Blue Mottled one coat kitchenware. This enamel must be applied quite a bit heavier than single coat ground and in its application the matter of greatest importance is evenness of distribution. Mill 100 lbs. frit, 4 to 6 lbs. clay (English Ball, Vallender or similar) 1 lb. Borax, ½ lb. Carbonate of Magnesia, 40 lbs. Water. Mill slightly coarser than ground coat. In mottling this with residue (or new) white, one common

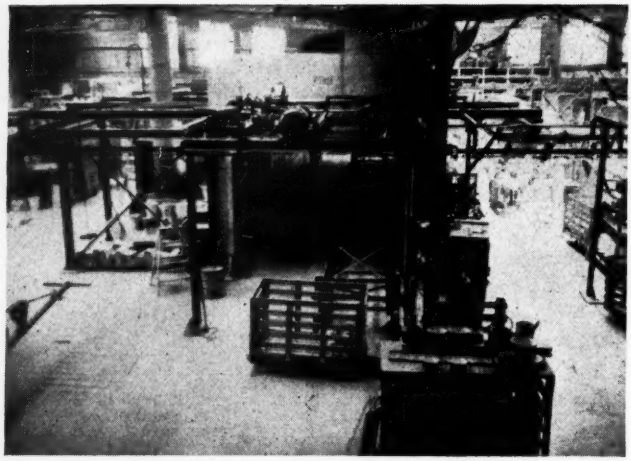

Fig. 4 — Illustration showing exit end of dryer. A "hang up" chain which travels out into the room for unloading can be seen at the right.

fault is using it too watery. This will burn out and leave a very poor mottle or stipple that is not clean-cut. The dryness and body of this mottle spray should have close attention and control. This applies to all types of mottling.

Great care should be taken not to oversmelt B-B-D. It should be stirred often at the last of the smelting. Any ware coated with this enamel which is not up to standard may be coated again with the same enamel.

B-80 with 1.65 per cent cobalt is a very fine beading enamel and with 6 per cent cobalt or rather 6 lbs. in place of 1.65 lbs. is one of the best of sign blues.

B-82 is another very excellent sign blue.

B-6 is a superlative white and base for innumerable colors made by the addition of oxides in the mill and is a good kitchenware, stove part, sign, refrigerator, reflector and general all round enamel. It is softer than B-1, which is also a fine general purpose enamel. To gain opacity, during the last 30 to 45 minutes of normal smelting time on these enamels, reduce the fire and let it soak down slowly.

Mill these enamels — 100 lbs. frit, 5/8 lbs. Vallender (or similar) clay, 6/8 lbs. Tin Oxide, ½ lb. Magnesium Carbonate, 2 oz. Epsom Salts. B-6 can be used in single coat work if properly applied.

B-AR-106 is an extremely good acid resistant enamel for such items as photographers' trays, table tops, stove and refrigerator parts, signs

COVER COATS

Chemicals	B-6	B-1	B-AR 106	B H H Glaze
Feldspar	19.0	34.3	.....	32.00
Silica	21.6	16.35	38.53	22.00
Fluorspar	5.3	4.1	3.67	.....
Borax	27.0	21.8	20.20	25.00
Soda Ash	4.0	2.8	5.5	6.00
Nitrate of Soda	3.0	1.65	7.34	5.00
Cryolite	11.3	16.35	.....	10.00
Zinc Oxide	4.8	1.65	2.75	.....
Antimony Oxide	4.0	1.05	.....	.....
Sodium Silico-Fluoride	.....	.....	5.5	.....
Nostane No. 4	.....	.....	16.51	.....
	100.0	100.05	100.00	100.00

and kitchenware. Mill 100 lbs. frit, 4 lbs. clay (or 2½ lbs. clay, ½ lb. Bentonite), ½ lb. Magnesia, 5 per cent Tin Oxide. The best appearing job comes from applying a thin coat of this enamel over a heavy coat of B-6, B-6 for opacity, 106 for acid resistance. Very thorough laboratory tests of this enamel shows it equal in acid resistance to any of the enamels on the market. It is also easy to work and may be used directly on ground coat. The Nostane No. 4 is a product sold by Ceramic Color & Chemical Mfg. Co., New Brighton, Pa.

B-H-H Glaze is a base enamel—a clear enamel for the addition of oxides to make many sign colors, particularly the Reds.

To make this formula list more complete, following are two very good dry process cast iron enamels in use on large quantity production at the present time:

Chemical	B-54	B-116 AR
Borax	24.5	.....
Feldspar	33.50	.97
Sodium Antimonate	11.00	11.21
Zinc Oxide	7.00	.....
Fluorspar	5.50	2.42
Nitrate of Soda	4.50	2.92
Barium Carbonate	7.00	.....
Litharge	7.00	22.43
Boric Acid	.....	5.36
Titanium Oxide	.....	2.92
Sodium Silicate	.....	51.70
	100.00	99.93

B-54 is a very good, wide firing range and very opaque ordinary, non-acid resistant white cover coat and base for colors.

B-116 AR is one of the most highly acid resistant white and color coat base cover coats in use today. 20 per cent H CL placed in a container coated with this enamel leaves no mark or loss of gloss whatever.

They can both be fired at furnace temperatures of from 1650 to 1700 F.

To store the enamel after milling, steel tanks were made in the sheet metal shop consisting of 6 units 2 ft. in diameter, and 4 ft. high to hold 800 to 900 lbs. of enamel (dry weight) and 4 units 2½ ft. in diameter by 5 ft. high to hold 1600 to 1800 lbs. of enamel. These storage tanks were cylindrical in shape, made of 18-gauge enameling iron and coated with two ground coats. They were mounted on wooden platforms 2 ft. high and discharged through 1½ in. diameter treacle valves set in a threaded pipe-fitting which had been welded into the side at the bottom. A metal framework was clamped to the top and held a stirring rod that ran down the center of the tank. On the bottom of the stirring rod was a four-bladed propeller-like agitator that threw the bottom enamel to the top as the handle fastened at right angles to the top of the ¾ in. rod was revolved around and around. A galvanized iron removable top with one side hinged for charging protected the

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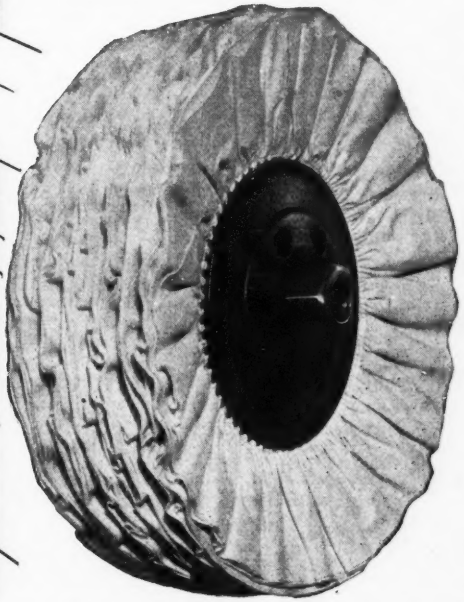

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enamel from any foreign material.

Between 30 and 40 special and color enamels were kept in 200 to 300-lb. capacity tanks in the same manner as the removable dipping tanks mentioned in the previous article.

In the old aluminum ware shop space, a new cleaning department was laid out and closed off from the rest of the plant with heavy wall board and a ventilating system installed. Outside the front end and through swinging doors was a storage space for fabricated wares ready for cleaning. These were kept as much as possible in exact order on lift truck platforms and in box trucks. Eight Monel metal baskets were fabricated. Two large ones 30 in. by 30 in. by 54 in. had trunnions in the centers of the ends and a removable lid suspended by the trunnions so they could be revolved for draining. These were loaded with kitchenwares on a regular loading platform. Two others were used for small kitchenwares and were 24 in. by 24 in. by 42 in. and four others of the orthodox flatware type were built to handle stove parts and signs.

In the pickleroom were two wooden cleaning tanks made of 4 in. Kauri wood (as good as cypress) and bound with monel metal bolts and nuts 3½ ft. wide, 6 ft. long, and 4 ft. deep. These were kept at boiling point with iron coils on the bottom and sides. Next, two 3-inch Kauri rinse tanks, three 4-inch Kauri pickle tanks kept at 150 deg. F., with lead coils on the bottom and protected by wooden stocks were used as two rinse and two neutralizing tanks. The tanks were in pairs with a cross walkway between each set. They were all set in a concrete trough sloping from each end to the center drain. The baskets of ware were moved by an electric hoist traveling on a monorail over the centers of the tanks. After the work pieces were removed from the last neutralizing tank, the baskets were swung at right angles and placed on an elevated (4 ft. from floor) roller conveyor. This ran through a gas-fired galvanized iron dryer with a strong up-draft hot-air circulation. On each end were book-type, double swinging metal doors. On the bottom of each pickle basket, monel metal runner strips were fastened over the monel rivets so that the baskets would travel smoothly on the conveyor. The dryer held three baskets at a time. The drying time averaged around 10 min. per basket. At the dryer exit end, the roller conveyor extended outside 8 ft., then curved. On this curve was the unloading platform from which a ramp led to a marked runway leading to ground coat application. As the basket was unloaded, it was given a shove which forced it on around the curve and then followed a descending course to within a few feet of the loading platforms and outside the closed-off pickleroom.

Figure 2 shows the left side of the pickle room wall looking from the front end. The ramp referred to above can be seen at the rear, and along this back wall is the runway marked in the same manner as the runway along the pickleroom wall. In the middle of the illustration the location of the brushing tables before the air duct exhausts were hooked up can be seen. Three months previously, this was the middle of a busy aluminum kitchenware shop.

Kitchenware from the pickleroom was taken to sorting tables where it was carefully examined for dents and imperfect cleaning. A full complement of mallets, (wood, lead, and rubber) and metal shapes, for pounding and pressing dents out was provided. From this point the ware was transferred to dippers at the end of the dryer shown in the illustration Fig. 3.

After dipping, the ware was placed on 6, 7, or 8 in. x 4 ft. boards, studded

with sharp pointed special nails, which left unnoticeable marks on the ware as it was placed crossways on the parallel dryer chains.

On the far side of the dryer around the extensions of the "hang-up" chain, the cover coat dipper tanks were stationed. Each dipper was provided with an attendant so that the dipper might do nothing else but dip. In addition, other workmen served the ware and recorded the amounts and kinds, with coat applied, on cards hung from each tank. On the near side of the dryer, the chain served several spray booths operating on kitchenware.

Though the end of the dryer is open, no heat escapes. On each end at the side and across the top are ducts and openings removing air from outside the dryer and from within the dryer. This re-circulates the moist air over coils of steam pipe (heated by the same 50 H.P. 90 lb. pressure boiler furnishing steam for the pickleroom), and adds non-humid quantities of fresh air from outside the dryer. This air movement forms a perfect heat seal. Just outside the dryer it is room temperature. Five feet away it is 140 deg. F. The re-circulated air is re-introduced into the dryer through two rows of pipes, 18 in. apart, parallel to the dryer sides and pointing down through the dryer roof directly at the ware on the conveyors. Previously, too much of the drying was done by the use of very much heat and very little circulation. This has the proper balance between the two, scientifically worked out.

Figure 4 shows the exit end of the dryer before it was used, showing space reserved for the later addition of another "lay down" conveyor chain. At the right can be seen where the "hang-up" chain travels out into the room for unloading. In front of the dryer is one of the 50 new trucks. A flat bottom mounted on two center wheels with two end wheels swiveled and all rubber-tired. The ware carrying crate on top is removable. The capacity is four crates to one bottom.

Phototube Pyrometer Catalog No. 1101D. A new 28-page pyrometer catalog, designated as "No. 1101D", has just been published by C. J. Tagliabue Mfg. Co. Park & Nostrand Aves., Brooklyn, New York. This catalog describes and illustrates many unique features of TAG Celectray indicating, recording and controlling pyrometers and resistance thermometers, which utilize a phototube, mirror galvanometer and a beam of light. This construction offers instantaneous action, accuracy of 0.1 per cent and high sensitivity. Large illustrations showing the mechanisms of various models are clearly marked and thus provide quick understanding of the instruments' operation. Copies of this catalog will be sent free by addressing C. J. Tagliabue Mfg. Co., Park & Nostrand Aves., Brooklyn, New York.

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Barrel Finishing of Metal Products

Fourteenth Article of Series—Factors in the Operating Technique of Oblique Tilting Type Barrels.

By H. Leroy Beaver

HITHERTO in this series of papers we have touched only briefly the subject of oblique tilting type barrels for finishing metal products, but of all the types operating in present day production methods this type of barrel and the underlying principles in its effective operation are undoubtedly the least understood.

H. Leroy Beaver

Inasmuch as this type of barrel is used in so many and varied operations, perhaps we had best first examine into and determine just where this type of barrel fits in with the general scheme of barrel finishing and especially so as it relates to the previously discussed high and narrow type as exemplified by the Abbot Barrel and the long and narrow type of barrel as exemplified by the Baird Barrel.

From all of the research we have conducted, we would definitely say that the oblique tilting type barrel for efficiency of operation comes just about midway between the high and narrow type and the long and narrow type, and especially so when the barrel is used for cutting down or deburring operations. This, of course, refers to its efficiency for performing the same class of operations as the two other types. As to flexibility of operation, the tilting type, of course, can be operated under so many variable conditions that it by far exceeds the applicability of the two other types, and as to such variable operations, it would be most difficult to set down all of the various methods of operation, and so for the purpose of this paper we will undertake to enumerate only the essentials of operation. Methods of handling various operations will be covered in a later paper.

As the reader perhaps already knows, barrels of this type may be had in cast iron, cast or sheet brass, aluminum or steel shell types. Here again we answer the question of which is the best type of barrel shell

by saying that there is no "all purpose" "best" type, but there is always a "best" type for a given operation.

Practically all of the barrel shells obtainable in the open market are what we might term "straight sided" type and by this we mean that there is no bowing of the barrel ribs in the wood types or forming of the metal parts away from the straight sided panels. In all of this type of barrel we have ever checked in operation there is one which distinctly stands out as more efficient than any of the straight sided varieties. This type of barrel was, for want of a better term, "bellied" out gradually for at least two-thirds of its length before being tapered toward the mouth. When we consider the greater efficiency of such a "bellied" type of barrel as compared to the straight sided varieties, the wonder is that some one of our barrel manufacturers have not long ago offered a type such as this to the metal finishing trades.

All barrels of this type must be paneled or in lieu of this, that is straight sided, they should have a number of longitudinal ribs so that the gravitational pull on the mass within the barrel will not counteract the centrifugal force to such an extent as to nullify this force because in so doing the mass of finishing materials and parts will lie in the bottom of the barrel shell and the shell will simply revolve around it. When the barrel is formed of panels generally twelve to sixteen in number, longitudinal ribs are not always necessary because this very break-up in the surface arc will be such that the mass of material and parts will be carried high enough upwards on the periphery of the barrel to produce the necessary "flow" of the mass. While barrels of this type are generally spoken of as "tumbling barrels", they are when properly operated, anything but a tumbling barrel and they can only become a tumbling barrel and perform a tumbling operation when they are operated at such high speeds that the mass is carried completely up to the highest point of the barrel shell and where the parts are permitted to be thrown completely out of the mass and to fall almost to the bottom of the barrel shell. Such an operating method invariably produces a "peened" effect on the surface of the parts being operated upon. While this might have been considered as a satisfactory operating method years ago, we are gradually learning that a violent tumbling about or churning of the entire mass in the barrel irrespective of its type, is neither necessary nor desirable or in any sense the best practice, or conducive to the best results.

The best description of the movement of the mass is what we might term a "flowing" of the mass of burnishing material and parts and this whether the burnishing material be steel, abrasives, sawdust or fibrous materials combined with the parts to form the mass, and this whether the operation be one of cutting down or burnishing.

In all of our research we find that we can obtain the best results when the mass is carried only from 2/3 to 3/4 of the distance up the side of the barrel towards the top. The movement of the mass is much the same as in the two other types of barrels, that is, the mass is carried up to a point **just below where it actually throws over the top**, and from here the mass should flow downward toward the lower side of the barrel with a characteristic dip or sag in the mass as it passes over the centre of the axis of the barrel.

When the height of the carry of the mass up the side of the barrel is in correct proportion to the size of the barrel and the load carried, the bottom of the barrel can just be seen above the top of the flowing mass

and generally almost one-third of the bottom of the barrel is bare and exposed, that is, in a dry operation, but this bottom would of course be hidden from view by soap lather if a soapy lubricating solution is used. This flowing mass in general contour could perhaps be no more aptly described than that it is "kidney shaped" because it rises at the highest point on the periphery of the barrel where it then starts its downward flow—sags perceptibly in passing over the centre of the axis of the barrel—and then again rises perceptibly as it contacts a point about one-third above the actual center of the bottom of the barrel.

There are many opinions as to the angle at which barrels of this type should be operated. Here again no hard and fast rule can be applied. In striving to arrive at some definite conclusion as to this phase, we finally determined that there is one method which invariably has given the best results, and it is as follows: Load the barrel so that when the mass levels off in operation about one inch of the bottom of the barrel can be seen above the highest point of the mass, and the former or frontal part of the mass should not come closer to the lip or mouth of the barrel than about four inches. In some barrels this may involve a tilt of 30 deg., in others as much as 45 deg., depending on the type and size of the barrel shell. Some barrels are more nearly straight sided than others and again we have barrels with comparatively wide bottom tapering rather sharply toward the top or mouth.

As we see these types of barrels in operation in various plants from day to day, we are always impressed with one phase of their operation, and that is a tendency on the part of the average operator to undertake too great a load or perhaps we should state it better by saying too much bulk per barrel load, and when this is done we also find that the barrel is tilted too high for efficient work. If the load is so great in bulk that the entire bottom of the barrel is hidden when in operation, it will be found that the layer of material covering the bottom of the barrel lies practically inert whether the layer be one, three or six inches deep, and when this type of barrel is so loaded, uniform results are impossible.

In discussing proper operating speeds for barrels of this type, we approach a difficult problem for the reason that each few degrees of tilt of the barrel shell creates a marked difference in the movement of the mass within the barrel and even the variation of the height of the longitudinal ribs as mounted in some barrels have a very definite tendency to alter the operation of the barrel as respects its speed for bringing the mass to the proper point on the barrel periphery where it flows over. Very often, indeed, the height of the inner ribs and the manner in which they are mounted definitely regulates the speed at which the barrel must be operated to obtain maximum efficiency. Let us, for example, cite this illustration—When barrels are fitted with longitudinal ribs, they are generally five or six in number divided evenly around the inner periphery of the barrel. Now let us suppose that our barrel is turning over at 45 r.p.m. If the ribs project one-half inch above the surface, one result will be obtained, but if the ribs project one inch above the surface an entirely different result will be had.

Generally speaking, the higher the longitudinal ribs project above the surface of the barrel shell, the slower the speed of rotation must be. Then too, the manner in which the ribs are placed bears a most important part and is a considerable factor in obtaining the best results. Ribs such as we have seen in some barrels running

in a straight line from the lip to the bottom of the shell are very inefficient. Ribs that start at the mouth of the barrel and run towards the bottom in the direction of the movement of the hands of a clock, are even less efficient because they will have a tendency to carry the mass toward the front or lip of the barrel and in some cases even to the extent of forcing parts entirely out of the barrel shell.

The proper and most efficient placing of ribs is to have them start from three to four inches in from the mouth of the barrel and then to taper toward the bottom of the barrel contrary to the motion of the hands on a clock so that the action will be not only to carry the mass toward the proper operating height but also to keep the parts being finished moving back into the mass or toward the bottom of the barrel.

Just as in the high and narrow and long and narrow types of barrels, the relation of the specific gravity of the mass and the parts sought to be finished equally applies. When a barrel of this type is operated tilted at an angle, the mass, of course, is most dense or deepest at the back or bottom of the barrel, indeed, the greater part of the active operation is obtained within a comparatively narrow and confined area.

If we take the very bottom angle of the barrel and draw a perpendicular line from this point directly upward through the mass, that portion of the mass lying between such an imaginary line and the bottom and back of the barrel is the area where the most efficient operation is obtained, and as the mass tapers off towards the mouth or front of the barrel the efficiency factor rapidly diminishes, but if the barrel shape or form is a correctly proportioned one, with longitudinal ribs properly placed, and the proper attention is

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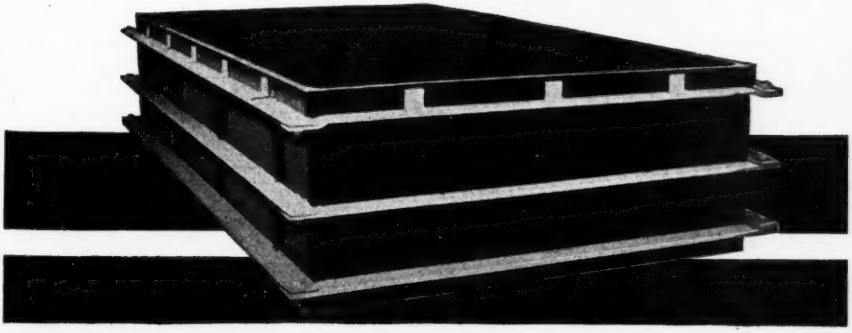

given to the relation of the specific gravity of the mass as relates to the parts to be finished, then efficient operation may be obtained because the parts will have a tendency to pass in and out of the mass, a condition that would be impossible if there was a very wide variation in specific gravity.

In operating barrels of this type with the tendency to overload, may we point out that the greater the overload may be, the more restricted and restrained the operation will be and consequently the less efficient both from point of time required to complete the operation and quality of finish obtained.

From our own experience as between cast iron shells and those formed from sheet steel properly proportioned and with welded bottoms and the proper compliment of ribs, we much prefer the latter type, both for cutting down or burnishing operations, where parts are burnished by the use of mild or soft polishing abrasives such as vienna lime, and again the latter are preferred due to their light weight. A cast iron shell weighing say 600 pounds will be duplicated for capacity in sheet steel at only about one-fourth this weight which means either that less power is required to operate or else heavier loads of material may be handled at no greater power cost.

Both in cutting down and in burnishing in this type of barrel seemingly the greatest efficiency is obtained when the barrel is loaded at less than its normal rated capacity. For example, if a barrel has a rated capacity of 2½ bushels or 1000 pounds, it will probably operate at a greater ratio of efficiency if the load is held down to around 700 pounds or about a bushel and three-quarters because this leeway will provide for operation at the most efficient angle as heretofore described.

Oblique tilting or open end type barrels as they are sometimes called are useful in many ways because they may be operated efficiently at greater load variations than would be possible with either the high and narrow or long and narrow types. Then again, they have the added feature that work in process may be examined in a moment at any stage of the finishing operation by simply picking a part from the mass. When light gauge products whether of metal or of plastics are being operated and where steel burnishing material cannot be used, these light and more flexible applications have a wide and useful range and especially is this true where some form of sawdust of vegetable fibre material is used with abrasive as the cutting down or polishing media, either plain or glue set-up and perhaps one of their most useful applications is for deburring light gauge metal products with abrasive mixtures as noted where the operation may be very plainly observed and stopped immediately when the desired finish is obtained.

Barrels of this type are useful and have their proper application and especially so on alloys containing magnesium or other elements where contact with excess alkalies may set up undue amounts of gas in operation which cannot be safely vented in the average closed type barrels. This latter, touches but lightly on a point which might well receive some stress in this paper. Quite frequently we receive sample parts from barrel operators with the complaint that the parts go into the barrel one color and come out an entirely different color. Almost invariably we find the condition to be caused by gas generating within the barrel due to chemical reactions between the parts and the constituent parts of the burnishing solution and which cause oxidation on the surface of the parts being finished. Not all barrels of the

closed type are provided by their manufacturers with vents, and where this condition applies, and indeed in the case of every closed type barrel, we recommend venting ports. This can be done by simply drilling a hole through the shell, tapping and fitting with a small hinge top type oiler. When vents are provided on barrels this is done by the manufacturer for a definite purpose and these vents should be kept open at all times, this being done by simply inserting a wire and cleaning out the air passage leading to the inner chamber of the barrel. At the very least, this should be done once a week and especially should this be attended to before placing the barrel in operation after it has stood idle for a time. To illustrate the lack of understanding of venting of barrels, we very recently received a letter from a barrel operator wherein he inquired what was the purpose of the oiler on the side of his barrel right at the flange edge, and if it was used to lubricate the main shaft why was there not an oiler on both sides of the barrel instead of only one side and also what would be the best type of lubricating oil to use. Of course, what he referred to was simply the hinged cap, air-vent. In ordering a closed type barrel one should insist that it have the proper vent before the barrel is shipped.

At least two manufacturers of oblique tilting type barrels supply them with both tight and also screen covers. In the manner in which the tight cover is generally used, we find another fallacy in barrel operation in that some operators first overload their barrel, then by clamping on the tight lid, they tilt the barrel with the mouth downward to pitch the load as far as possible toward the front of the barrel little realizing that in so doing they are retarding rather than accelerating the operation. Any op-

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eration in this type of barrel by this method will be slower because the foot travel of the parts through the mass is necessarily shorter per revolution in the small tapered end of the barrel with its lighter pressure than that compared with the bottom or base of the barrel where as we have heretofore explained the most effective results are obtained.

A screen cover is a splendid auxiliary to the operation of this type of barrel in that when any given operation in a cycle is completed the liquid may be drained from the barrel by using the screened cover and still retain the parts in the barrel for further processing—such, for instance, as an abrasive run on steel parts to cut down and smooth the surface after which the mouth of the barrel can be tilted downward and the abrasive material completely flushed out with a stream of water, after which the barrel can be again tilted to its normal operating position and a succeeding charge, such as vienna lime and water added, and indeed as many as four and five successive operations may be conducted on the parts without removing them from the barrel until the final barrel operation in the cycle has been completed.

In addition to the metal shell barrels of the oblique tilting type, the shells may also be obtained for both wet and dry work made principally from maple wood, and again we have this type of barrel in metal shell type with screen inserts placed in the lower periphery of the barrel for screening of various kinds, also with steam jacket for hot japanning operations or hot sawdust drying and again another modification of this type of barrel is one wherein the bottom angle is rounded to approximately a twelve inch radius and which is operated with a 12 in. steel ball which rolls in this radius and acts as a crushing medium for various kinds of pigments or chemicals. The oblique tilting barrel, mostly with brass shell, is the barrel type principally used in the cream of tartar finishing process covered by the paper in the February issue of Products Finishing.

Perhaps the most highly developed of the oblique tilting type barrels, for cutting down and grinding purposes is the soft rubber lined barrel as briefly described in a previous paper, and in connection with this brief previous description we have met with a pleasant and interesting surprise as an off-shoot to rubber lined barrels for handling work requiring abrasive treatment. It was the writer's privilege to attend the January meeting of the New York Branch of The American Electroplaters Society, and during a brief discussion of burnishing problems one of the branch members spoke of the difficulty he had with a piece of sand blast equipment in that the pipe bends on the abrasive carrying lines were worn completely through at very short intervals. After reading the comment on soft rubber barrel linings the idea was conceived of replacing the metal pipe bends with high pressure rubber hose, simply as an experiment, and much to their gratification the rubber hose bends show promise of wearing almost indefinitely, as after considerable use they show no wear. Perhaps there are other readers with a similar problem that would respond to the same treatment.

In closing this paper, may we again suggest that if any of the readers of Products Finishing have any problems that have not as yet been touched upon in this series and which would be to the interest of readers generally, that they send them in and they will be commented upon in succeeding papers.

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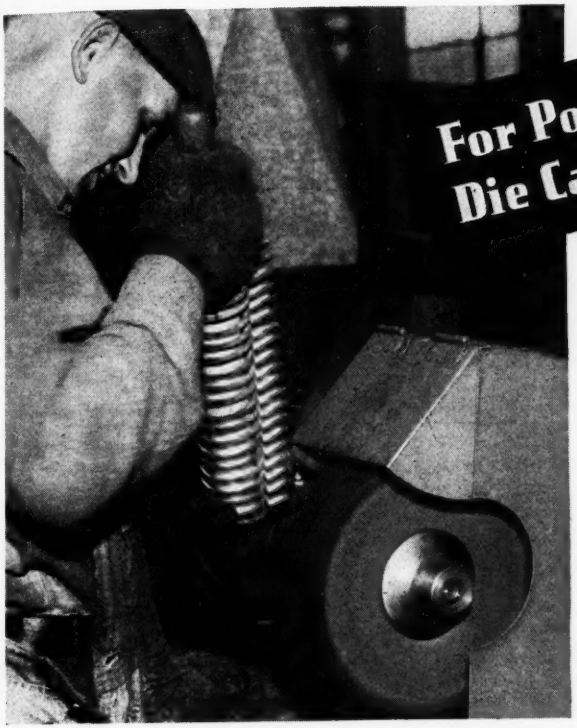

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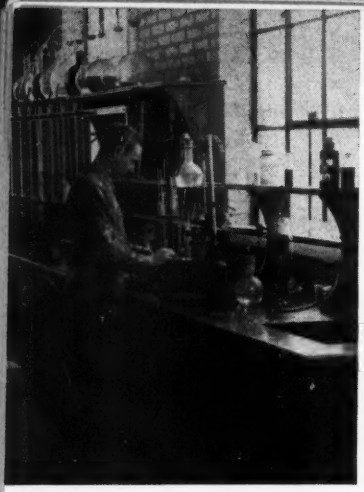

the FINISHING FORUM

Question:

We manufacture an electric-welded cold-rolled steel double-boiler tank used to heat a gelatin mixture. The outer tank contains electric heating elements in an oil bath and the inner tank contains glycerine, glue, a small amount of borax, and about 25 per cent water. The temperature in the oil bath is 200 degrees Fahrenheit and that keeps the glycerine-glue mixture at a temperature of 155 degrees Fahrenheit.

In the past we have rust-proofed the inner tank with .0003 to .0004 inch thickness of cadmium. This costs about $5.00 per tank and presents a good appearance, but we have found that the cadmium surface wears through and the tank rusts. The glycerine is stirred with a wooden paddle while the tank is in operation and in some cases the tank is cleaned with a wire brush. This abrasion is perhaps more responsible for the plate failure than chemical corrosion.

Can you suggest any means of better protecting this metal at a reasonable cost, and some means that will present a good appearance? We have considered spraying or metallizing the inside of the tank with tin, copper, or zinc, or plating it with copper.

Answer:

First, in the consideration of your problem, let us disregard the outer tank of your double-boiler. Any cheap finish that you wish to use on that tank will be satisfactory since it is not subject to much corrosion. A good grade of paint would probably be very satisfactory. If you wished to go to a higher-grade finish, a good aluminum paint could be used. There is one manufactuer who markets an outstanding aluminum paint which retails for approximately $5.00 per gallon. This paint has very good rust resisting qualities, but, of course, it will not stand much abrasion.

In the consideration of the proper finish for the inside tank, or chemical vat, the problem of a satisfactory or enduring finish will be dealt with first. Then by comparing costs on the various finishes a compromise can be made between quality and cost, and the desirable finish can be se-

lected without much difficulty.

There are two finishes that would prove entirely corrosion-resistant under the conditions outlined in your letter. The first is hot-dip galvanizing. The second is acid-resisting porcelain enamel which could be supplied in white or colors. Galvanizing and porcelain enameling job shops in the Chicago district could supply you with cost estimates. The hot-dip galvanizing has an advantage over the acid-proof enamel in that it is not subject to chipping and can be fabricated easily. The porcelain enamel might crack or chip either during assembly of the double-boiler or after assembly, due to strains set up in the metal.

Some other possible finishes which are cheaper and correspondingly less corrosion resistant will now be considered. Such finishes are electroplated zinc, cadmium, nickel, copper, and combinations of copper and nickel. Electroplated zinc is recommended as the best of the group both as to effectiveness and cost. A dull-finish zinc should be plated on about .001 to .0015 inch thick. Zinc has the disadvantage of being soft like cadmium, but it is considerably cheaper than cadmium—thickness for thickness. Zinc metal usually sells around $.15 per pound whereas cadmium has been selling from $1.05 to $1.32 per pound. Cadmium also has the disadvantage of being soft and easily abraded. An electroplate of straight nickel about .0008 to .001 inch thick would present a harder surface and practically the same corrosion resistance exhibited by the electroplated zinc. Nickel usually costs about $.50 per pound so that such a finish would be about 2 or 3 times as expensive as zinc. A combination of a .0007 inch thick copper base coat under a .0005 inch thick nickel cover coat might prove more economical and would be only slightly less effective than the straight nickel. Copper alone would be objectionable because it would stain and corrode more readily than any other finish suggested.

As you state in your inquiry, it is quite possible that the cadmium on your tanks now is worn away by abrasion rather than by chemical corrosion. You state also that you have considered spraying the inside of the tank with tin, copper, or zinc. Sprayed coatings are usually more porous than electroplated coatings and hence show less corrosion resistance—thickness for thickness. However, under proper conditions, if the desired thickness can be obtained, sprayed coatings stand up very well. The only coating of the three you suggest that might give satisfaction in your case is the zinc. Copper, as has been stated, stains and corrodes readily. Tin is very soft; it is rather expensive, and it offers no outstanding corrosion resistance.

With these suggestions in mind you can get quotations on the various finishes suggested and discussed, and

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select the one that most nearly meets your needs and fits your pocketbook. Of course you can reduce the thickness of any finish from that thickness recommended, but by doing so, you substitute economy for satisfactory service.

(*Answered by Ezra A. Blount.*)

Bristol Recorders for Electrical Unit Readings Bulletin No. 496. Recorders for electrical unit measurements are described in a new bulletin now available through The Bristol Company, Waterbury, Conn.

The operating characteristics of these instruments and their various applications in the utility and industrial fields are given. Among the industries referred to in the publication are the chemical, plastics, ceramics, rubber products, pulp and paper, metals and food products manufacturers. Their use of electrical instruments in the control of machine operation or variable factors that can best be expressed by electrical means, is briefly described.

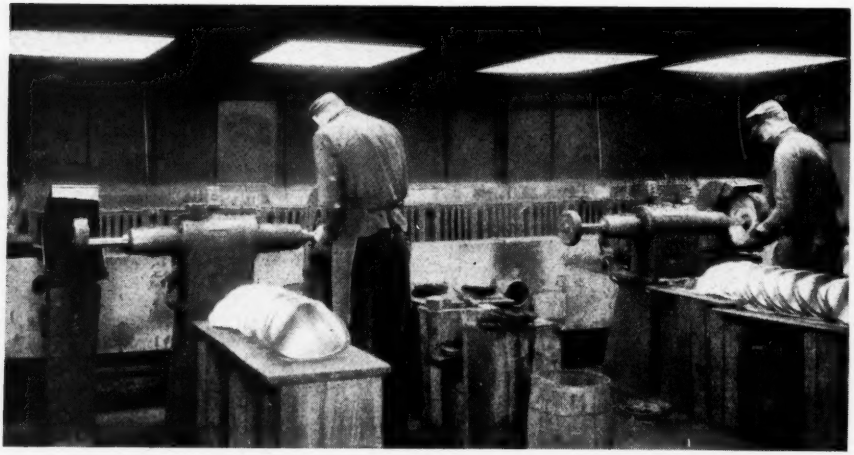
The information contained in this new bulletin shows how Bristol's electrical recorders are used to give close control and reveal losses in excess power consumption that may be readily eliminated.

A copy of Bulletin No. 496 may be obtained upon request.

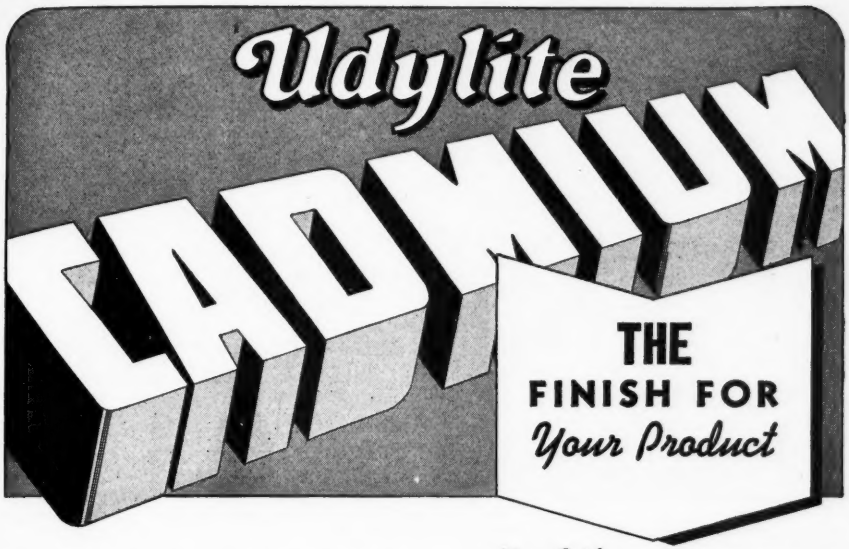
Condor Compensated Belts. The Manhattan Rubber Mfg. Division of Raybestos-Manhattan, Inc., Passaic, N. J., has just issued an illustrated 4-page bulletin entitled "Condor Compensated Belts". In addition to describing the reason for compensating rubber belts and the compensated principle, the new folder explains in detail the merits of this type of belt. Engineering data essential to the proper selection, application, and supervision of belts is also included. Copy free upon request.

Hancock Blow-Off Valve Bulletin No. 8500. Hancock Valve Division, Manning, Maxwell & Moore, Inc., Bridgeport, Conn., is now offering a 4-page bulletin designated as "No. 8500" in which Hancock Blow-Off Valves are described. The principle of the Hancock "Blo-Deflector" valve seat and disc is illustrated and described. Other distinctive features of this valve are also described and illustrated. The composition of each type of the new valve is listed in tabular form as to part, material, and specification. Copy free upon request.

Mention PRODUCTS FINISHING when writing to advertisers.



Fine buffing and polishing requires first-class "seeing" facilities—in other words, good lighting. This large area diffusing unit provides approximately 50 ft. candles of well diffused illumination for this task at the point of work.



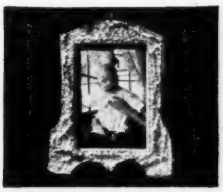
UDYLITE-CADMIUM is the trade name for pure metallic cadmium coatings applied to a very wide variety of metal products. The metal is applied by the Udylite Process, the simplest, most efficient method of cadmium plating known. Udylite-Cadmium is used where the combination of efficient corrosive protection and attractive appearance is desired at low cost.

Regardless of what finish you are using, investigate the possibilities of Udylite-Cadmium applied to your product. We will gladly plate any samples you send to us. ***The Udylite Company,*** 1651 E. Grand Blvd., ***Detroit, Michigan—New York,*** 30 E. 42nd Street; ***Chicago,*** 1943 Walnut Street; ***Cleveland,*** 3756 Carnegie Avenue; ***San Francisco,*** 114 Sansome Street.

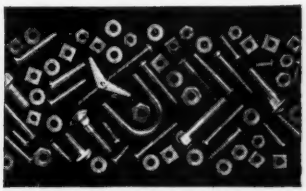
No Other Finish Offers ALL These Advantages

Rust Protection—Udylite-Cadmium is recognized as one of the best protective coatings available. **Beauty**—Udylite-Cadmium has an attractive, silvery-white lustre which is definitely appealing to the eye. It has a high tarnish resistance. **Economy**—Udylite-Cadmium coatings are not expensive because their application requires no polishing, buffing or coloring operations . . . because the coatings are easily and simply applied by the Udylite Process. **Easy to Solder**—Udylite-Cadmium coatings find a wide application because they solder easily with non-corrosive fluxes. **Broad Application**—Udylite-Cadmium may be applied to steel stampings, screw machine parts, forgings, castings; grey and malleable iron castings; and many non-ferrous metals without difficulty.

Udylite-Cadmium plated radio condenser chassis. Manufacturers of stamped steel parts prefer Udylite-Cadmium because of its rust protective properties, appearance and low cost.

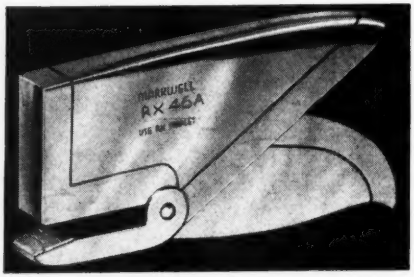


This small casting is Udylite-Cadmium plated. The high covering power and the ease of application make it the ideal protective coating for castings.



Bolts, nuts, washers, fittings receive efficient protection against rust with Udylite-Cadmium. The coating is deposited uniformly on the threaded surfaces permitting positive operation.

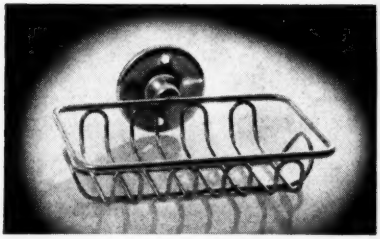
FINISHES THAT AID IN APPEARANCE AND UTILITY



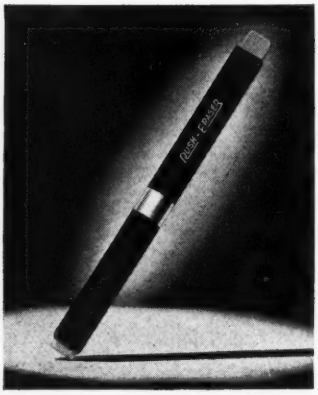
(Photo courtesy Markwell Manufacturing Co., Inc.)

(Left)—This pocket-size plier stapler is finished in a high-grade copper and nickel base with a surface coating of gleaming chromium plate.

(Right)—The inexpensive wire soap dish illustrated herewith is copper flashed and bright nickel plated directly on unburnished steel. The finishing operation is simple and economical due to the fact that no preplating polishing is necessary.

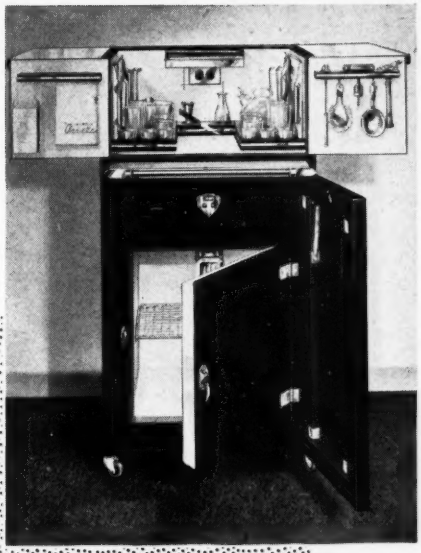


(Photo courtesy The Udylite Company)



(Photo courtesy The Eraser Company, Inc.)

(Left)—The metal band which controls the propelling and repelling action of this unique eraser is highly polished with a fine grade abrasive powder.

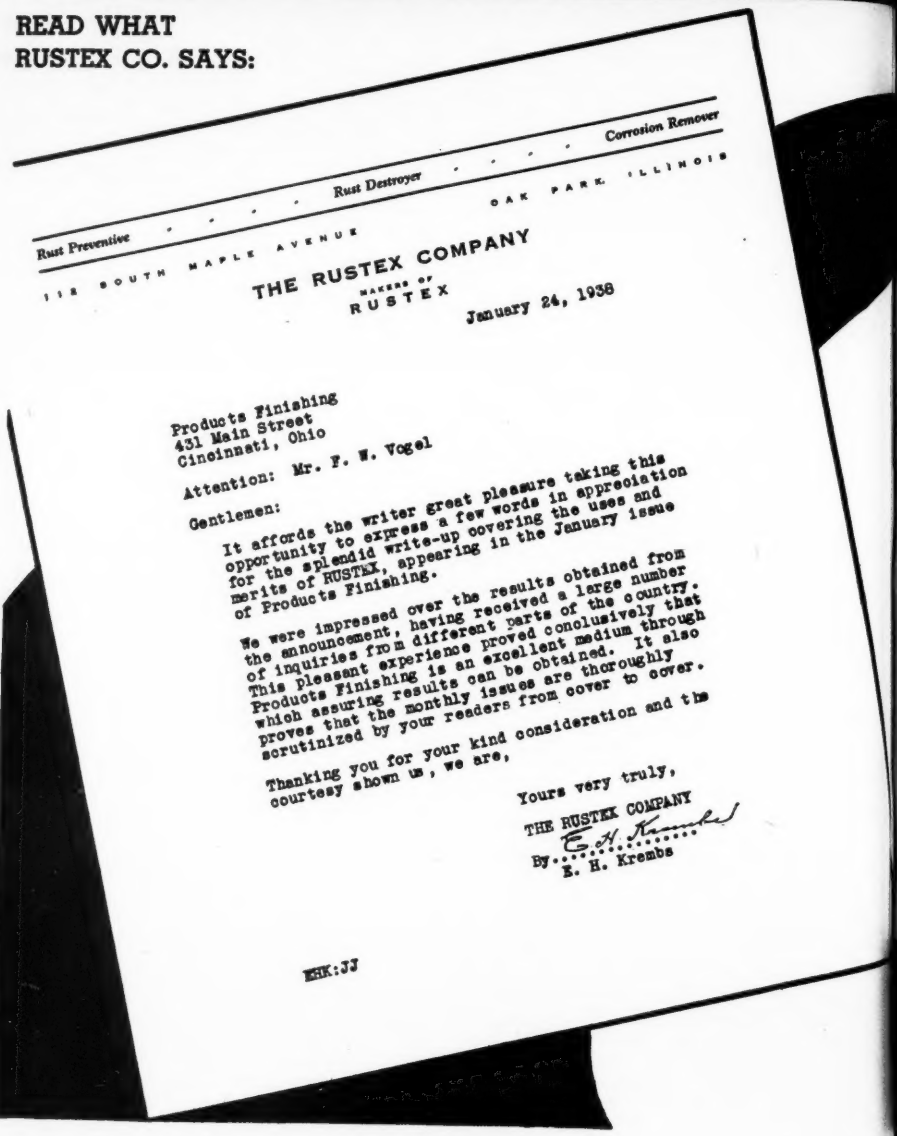


(Right)—A finish that aids in utility — the all-steel interior surface of this Electric Invisible Bar-ette is finished with ivory porcelain enamel. *(Photo Courtesy Invisible Kitchen Co.)*

(Left)—A finish that aids in appearance — the exterior surface of the Electric Invisible Bar-ette shown herewith is finished with two coats of enamel which are baked on. The available colors for this particular unit are a new "blonde" shade and lettuce green. *(Photo Courtesy Electric Invisible Kitchen Co.)*

PRODUCTS FINISHING GETS IM

READ WHAT RUSTEX CO. SAYS:



Rust Preventive . . . . . Rust Destroyer . . . . . Corrosion Remover

118 SOUTH MAPLE AVENUE OAK PARK, ILLINOIS

THE RUSTEX COMPANY
MAKERS OF
RUSTEX

January 24, 1938

Products Finishing
431 Main Street
Cincinnati, Ohio

Attention: Mr. F. W. Vogel

Gentlemen:

It affords the writer great pleasure taking this opportunity to express a few words in appreciation for the splendid write-up covering the uses and merits of RUSTEX, appearing in the January issue of Products Finishing.

We were impressed over the results obtained from the announcement, having received a large number of inquiries from different parts of the country. This pleasant experience proved conclusively that Products Finishing is an excellent medium through which assuring results can be obtained. It also proves that the monthly issues are thoroughly scrutinized by your readers from cover to cover.

Thanking you for your kind consideration and the courtesy shown us, we are,

Yours very truly,

THE RUSTEX COMPANY

By E. H. Krembs

EHK:JJ

IMPRESSIVE RESULTS FOR RUSTEX!

quote:- . . . "impressed over results . . received a large number of inquiries . . . This pleasant experience proved conclusively that Products Finishing is an excellent medium through which assuring results can be obtained . . ."

From the Rustex Co., Oak Park, Ill., comes the latest expression of complete satisfaction over the ability of PRODUCTS FINISHING to get results!

Your advertising message in this magazine reaches the most complete, hand picked list of important buying executives in the metal finishing field **and sells!**

You can get a bigger share of business from the metal cleaning, plating, and finishing industries through advertising in PRODUCTS FINISHING.

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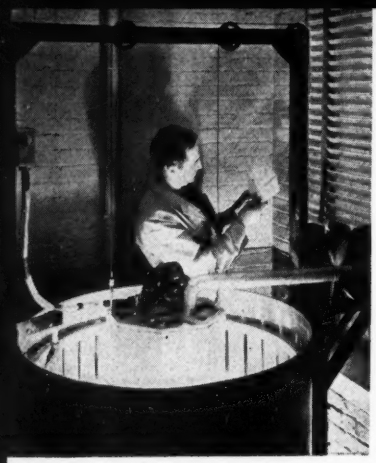


NEWS OF THE INDUSTRY

Platers Research Appoint Technical Director and Technical Adviser

S. C. Taormina has been appointed technical director of the Platers Research Co., 74 Grand Ave., Brooklyn, N. Y. Mr. Taormina graduated from the Industrial Chemical Engineering course at Pratt Institute of Technology in June, 1923. Since then he has been chemist and engineer for a number of firms in related industries. In 1932 he joined the U. S. Research Corp., under Dr. L. C. Pan, as service engineer, and later succeeded Dr. C. B. F. Young as technical director. In July, 1937, Mr. Taormina opened his own laboratories as consultant in the electroplating field.

Dr. C. B. F. Young, well-known electrochemist, has been appointed technical adviser to the Platers Research Co., Brooklyn, N. Y. This company specializes in the manufacture of control units for the analysis of electroplating baths.

Chas. W. Rauch Appointed Advertising Manager of Marlin-Rockwell Corporation

Chas. W. Rauch was recently appointed advertising manager of Marlin-Rockwell Corporation, 402 Chandler St., Jamestown, N. Y., to succeed Mr. A. A. McGowen who died on October 28. Mr. Rauch for the past ten years has been manager of the Technical Publications Department of that company, and has compiled and edited the various manuals, catalogs, bulletins and engineering literature on ball bearings and their application issued by Marlin-Rockwell Corporation. The two departments are now combined under one head, and all advertising and technical literature will be under the supervision of the advertising manager.

Mr. Rauch has been identified with M-R-C for the past 20 years. For the first ten years he served in the Engineering Department in the successive capacities of designer, chief draftsman, sales engineer and consulting engineer. Before entering the employ of Marlin-Rockwell, Mr. Rauch was engaged in various phases of mining, civil, railroad and mechanical engineering. He is a graduate of Lehigh University in mining engineering.

Carl Zeiss Appoints District Representatives

Carl Zeiss, Inc., who lately established a special department in their headquarters and showrooms at 485 Fifth Ave., New York, to handle the sales and servicing of their extensive line of precision gauging tools, measuring instruments, toolmakers' microscopes and projectors, announce the appointment of district representatives.

Mr. Sid Langston, 1213 West Third St., Cleveland, will represent the Zeiss line in northern Ohio. In Pittsburgh, western Pennsylvania and West Virginia,

Zeiss will be represented by Mr. Edward W. Voss, 2882 East Liberty Ave., Pittsburgh, Pennsylvania.

The agency for Chicago, southern Wisconsin and northern Indiana has been placed in the hands of Messrs. Higgins & Linde, Inc., 564 West Randolph St., Chicago, Illinois.

Chicago Vitreous Enamel Product Company Announces Promotion of Ed. Smith

Mr. Ed. F. Smith has been promoted to the position of district sales manager for Michigan, Northern Ohio and Eastern Pennsylvania for the Chicago Vitreous Enamel Product Company, Cicero, Illinois. Mr. Smith has been with Chicago Vitreous in the sales and service capacity for five years. He was formerly associated with the Renown Stove Company, Owosso, Michigan, as enamel plant superintendent.

Oakite Division Managers Hold Three Day Conference

Three distinct and recent improvements in production and maintenance cleaning practices were subjects of major interest in a three day tec' nical discussion of the Oakite Division Managers of Oakite Products, Inc., 20 Thames St., New York, N. Y., at their recent meeting held in the headquarters office in New York.

One was the elimination of brushing and mechanical wiping in the removal of insoluble smuts, buffing compounds and pigments from metals preparatory to finishing operations. The second dealt with the safer, easier methods that have been developed for removing hard water scales and rust accumulations from the water jackets of Diesel engines and other similar water cooled equipment. The third covered the development of a new series of cleaning materials that resist chromic acid contamination, making unnecessary the dumping of such tanks at frequent intervals.

Periodic get-togethers of the Oakite Division Managers, and of the entire service organization of nearly 100 men enable an exchange of views on all phases of cleaning, which assures each user of Oakite products being constantly acquainted with every advance in cleaning methods or materials that apply to his work.

E. Reed Burns Celebrates Fifty Years of Continuous Operation

Fifty years of continuous service to the metal polishing and buffing trade are being celebrated this year by E. Reed Burns Manufacturing Corporation, 21 Jackson St., Brooklyn, N. Y. In the year 1888, E. Reed Burns started in a very small shop under the first Brooklyn Bridge. At that time, he made only Crocus and the then new Vienna Lime Compounds for stove companies who were heavy consumers of polishing and plating materials on the parlor stoves, which were so popular at that time. The production soon expanded to in-

Oakite Division Managers and Office Departmental Heads who attended three-day conference.

clude all the supplies used in polishing and plating. In 1892, the shop was moved to 40-42 Withers St., Brooklyn, N. Y. Later, property was purchased on the adjoining street and now all the manufacturing departments are located at 21-27 Jackson St. The original building on Withers Street is at present a warehouse for material ready to be shipped. The company has been consistently under family management since its beginning.

The company now specializes in the production of top quality buffing compositions for every buffing operation, as well as buffing and polishing wheels. All of the products are identified by registered trade names.

The Ohio Electric Appoints Representatives

The Ohio Electric Mfg. Co., 5900 Maurice Ave., Cleveland, Ohio, has recently appointed representatives for the sale of Ohio fractional size motors as follows: C. D. Blincoe, 2123 Trevillion Way, Louisville, Ky.; H. L. Prather, 2708 Essex St., S.E., Minneapolis, Minn.; and Delavan Engineering Co., 414 Twelfth St., Des Moines, Iowa.

The company makes split phase, capacitor, polyphase, and shaded pole A.C. motors and D.C. motors.

It is now introducing a new line of streamline A.C. motors with solid base—resilient mounted and belt tightener for under and over belt drives.

Hotel Schroeder, Milwaukee, Selected for American Electro-Platers' Society Convention Headquarters

The Hotel Schroeder, Milwaukee, Wis., has been selected as the 1938 American Electro-Platers' Society Convention headquarters. Hotel Schroeder is said to be the largest, most modern and most centrally located hotel in the city. There are 850 guest rooms available. A cordial invitation is extended to everyone attending the American Electro-Platers' Society Convention to make the Hotel Schroeder his headquarters at the time of the convention. Many of the convention activities will be held at the hotel.

Eclipse Air Brush Company Moves

Eclipse Air Brush Company, Inc., announce the removal of their office and factory to 390 Park Ave., Newark, N. J., after 29 years in downtown Newark.

The building formerly occupied by the company was damaged by fire on December 14, in one of the largest and most serious blazes seen in Newark for many years. Production and shipping schedules are being maintained from the Park Avenue address.

Ferro Enamel Announces Changes

Ferro Enamel Corporation, Cleveland, Ohio, has announced the transfer of Mr. Harry Marks from the Cleveland plant to the company's branch plant located at Sao Paulo, Brazil. At Sao Paulo, Mr. Marks will have complete charge of Ferro Enamels South America. To assist Mr. Marks, Mr. Roland Schlegel has been transferred to Sao Paulo from another branch plant at Buenos Aires, Argentina.

Other changes announced by the company are the transfer of Mr. Ralph Bevis from Cleveland to Buenos Aires, where he will take charge of technical and control work of Ferro-Argentina and the promotion of Mr. A. B. Kimpel to replace Mr. Marks as export manager of the Cleveland plant.

Correspondence Electroplating Course

A complete course in electroplating, conducted by Dr. C. B. F. Young, electrometallurgist, Box 292, Flushing, Long Island, New York, is now available to students outside the New York area. The course consists of equipment such as chemicals, glassware, books, paper, analytical balance (sensitive to 1/10 milligram), weights, and 12 lessons. On receiving the first course, the student studies the lecture notes, performs all indicated experiments and writes all the data necessary on paper provided with the course. All lessons are corrected and filed in a special loose leaf notebook which is provided.

The lecture notes are devoted to a theoretical consideration of electroplating and the laboratory exercises help the student apply these principles. Copper, nickel, tin, zinc, cadmium, chromium, silver and brass are deposited from aqueous solutions; aluminum is anodized and colored. While the above metals are being plated, the factors governing the character of the deposit are noted by the student.

During the deposition of these metals, Faraday's Law, addition agents, throwing power, and hydrogen ion concentration, are studied. The effect of temperature, current density and impurities, are

also noted. Other experiments include the study of thickness of deposits, electrical resistance of plating solutions, current efficiencies, and so on.

After the above has been completed, the student makes up his own standard analytical reagents (using the analytical balance) and analyzes all plating solutions made for their constituents.

If the student has had a course in chemistry, this course may be taken direct. If not, a special course is provided where the student can obtain the fundamentals of chemistry as applied to electroplating.

Stainless Steel Exhibit at Rockefeller Center

An exhibition of stainless steel has just been opened for a period of several months in the New York Museum of Science and Industry, RCA Building, Rockefeller Center, New York City. This exhibit, which is sponsored jointly by Electro Metallurgical Company, unit of Union Carbide and Carbon Corporation, New York, and the Museum, will be open every day from 10:00 A. M. to 10:00 P. M.

Every aspect of stainless steel—its history, development, production, fabrication, and uses—is portrayed in a comprehensive, interesting and educational manner. The display includes hundreds of stainless steel products sent to the exhibit by manufacturers from all parts of the United States. The fields of application receiving special emphasis are the household, the food and beverage industries, general industry, transportation, architecture, and the medical and dental professions.

The displays of stainless steel products are supplemented by motion pictures and demonstrations showing why stainless steel is an important contribution to mankind, its usefulness in the food industry, its adaptability for strong, lightweight structures and for high-temperature service, and its importance in architectural applications. Every step in the production of this important alloy is illustrated.

Hilo exhibit of decorative and protective coatings displayed at the Heating and Ventilating Exposition, New York City

Interestng demonstrations showing the superiority of stainless steel to ordinary steel include tests with various kinds of acids, such as acetic, lactic and nitric, on both the stainless and ordinary steels. Other tests include salt water spray tests, heating to elevated temperatures, and a demonstration showing the comparative ease with which soot can be removed from stainless steel.

Operators give actual demonstrations of oxy-acetylene welding stainless steel in connection with a talk outlining the methods by which many types of stainless steel equipment are fabricated. The "Shotweld" system of joining stainless steel is also demonstrated. It is used in making lightweight structures for aircraft, railroads, and other transportation units. One interesting demonstration shows the sandblasting method of etching stainless steel.

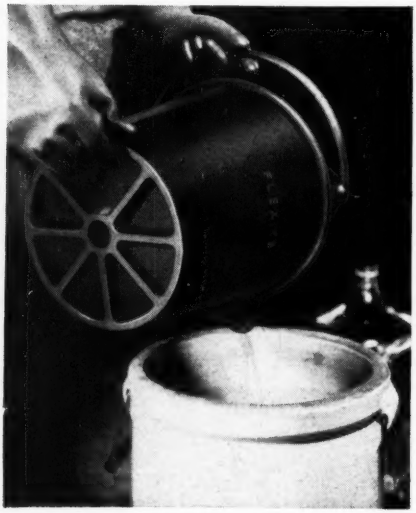
NEW
Plant Equipment & Materials

Goodrich Flexite Acid Bucket

An acid bucket, known as "Flexite", has been recently placed on the market by The B. F. Goodrich Company, Akron, Ohio. The Flexite bucket is said to provide a safe method of handling corrosive liquids.

The Flexite bucket is made of a semi-flexible material which will not crack or break under normal use. A reinforced bead on the base is not only enlarged but recessed to permit the worker to get a firm hold with his gloved hands. A capacity scale molded on the inside of the bucket provides a margin of safety to protect against spillage. When the bucket is filled to capacity, the liquid is still two inches from the top. Graduated marks also enable the user to measure quantities accurately.

Flexite buckets are available in 3 gallon sizes only. Weight of each bucket is 3½ pounds. Each bucket is designed with steel or metal reinforced hard rubber handles.



Goodrich Flexite Acid Bucket

Polymerin

A new industrial finish which is said to attain the production speed of lacquers and possess the desirable qualities of permanence and durability common to synthetic resin finishes, to be known as "Polymerin", has been announced by Ault & Wiborg Corporation, Dana and Thomas Aves., Cincinnati, Ohio. This product is said to be the result of a distinctive formulation. Its action is due to the principle of polymerization, a chemical reaction whereby molecules combine under suitable condions to form molecules of more complex and stable structure. Polymerin does not dry by oxidation.

Oven temperatures and the mass of metal to which this new finish is applied determine the processing time, which varies between a few minutes and a few seconds. Only one bake is required. Polymerin provides a suitable finish for washing machines, office equipment, metal furniture, toys, stoves, hospital equipment, plant machinery, electrical appliances, and other types of metal products.

Polymerin handles in much the same manner as other finishing materials inasmuch as it sprays freely and can be used in the dipping process.

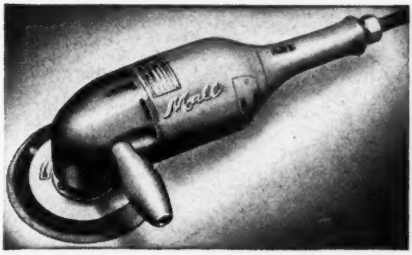
Tests at the research laboratories of the Interchemical Corporation show Polymerin to be resistant to all common deteriorants. Its characteristics of flexibility and adhesion are reported to be

equal to those of synthetic resin finishes. Polymerin comes in any color and any degree of gloss or dullness. It is available in white, which is permanent to sunlight. Polymerin is well adapted for products like washing machines, hospital and laboratory equipment which are subjected to alkalies, acids, and discoloring agents. In many applications, Polymerin is said to adhere to the base metal and does not require an undercoating.

Polymerin is said to set-up so rapidly that a dust-free surface is the result. It will not collect dust or foreign particles floating in the air either before or during polymerization.

Mall Portable Universal Electric Disc Sander

Mall Tool Company, 7738 South Chicago Ave., Chicago, Ill., has recently placed on the market a new Portable Universal Electric Disc Sander. This sander has a heavy duty ball bearing motor that operates the sanding disc 4,500 revolutions per minute. It is said to be fast and powerful, comfortable in the hands and easy to operate and control. It is said to be an ideal unit for production work.



Mall Portable Universal Electric Disc Sander

The new Portable Electric Sander comes in a heavy cardboard container. Standard equipment includes 20 ft. of 3 conductor cord and rubber plug, a heavy duty switch, at 7 in. pad and one abrasive for metal sanding. The unit is recommended for grinding and smoothing down wheels, steel and iron castings, auto body and fender work, and removing rust and scale. A cup shaped grinding wheel or tire brush can be substituted for the pad and abrasive disc.

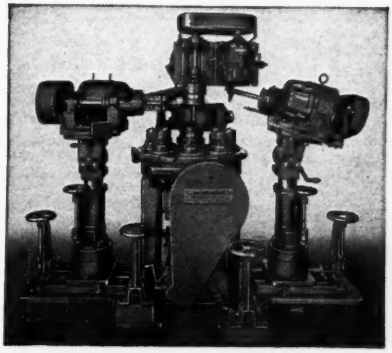
POLISH and BUFF

-Automatically-

Definitely lower hour costs with production materially increased.

3 Types of Machines Rotary (shown) —Straight Line Conveyor—Portable Vertical for various shapes and sizes of Parts.

WRITE DEPT. "F" for Catalog.



PACKER

Automatic

POLISHING & BUFFING MACHINES

THE PACKER MACHINE CO. **MERIDEN, CONN.**

Paasche Flock Airbrush Type GPRF

An airbrush for applying flock, powders and granules, to be known as the "Type GPRF", is being marketed by

Paasche Flock Airbrush Type GPRF.

Paasche Airbrush Co., 1910 Diversey Parkway, Chicago, Illinois. The Type GPRF Airbrush is said to aid in producing attractive suede-like finishes on metal. It is said to be ideal for applying dry powders and granules. The flock is directed in a wide or round fan spray without any clogging of the multiplehead. The Type GPRF Airbrush is said to be ideal for rapid and efficient operation.

Lustrebright Nickel Plating Process

A nickel brightening process that can be used previous to chromium, to be known as "Lustrebright", is now being marketed by Lustrebright Company, Inc., 240 Sheridan Ave., Albany, New York. The Lustrebright Process is said to be a revolutionary development in the electrodeposition of nickel. Brilliant, lustrous deposits that may be chromium plated, are produced on all classes and sizes of work by merely adding Lustrebright to any standard formula. No color buffing or burnishing is required and no extra effort is involved. Articles to be plated with chromium can be transferred directly from the nickel to the chromium bath without intermediary buffing, recleaning or reracking.

No changes in equipment or preparatory cleaning are required. Uniformity

"NO-TARNISH"
#21 Brass #22 Silver #23 Copper
Durable clear finish for polished metals.
In use nationally for 20 years.
SPECIFY IT FOR OUTSIDE USE
Samples on Request
CLEAVELAND
LABORATORIES & MFG. CO., Inc.
447 Wilson Ave., Newark, N. J.

SMOOTHER SPRAY
—and smoother work, smoother production, with the Milburn paint spray gun. Wide, wet spray — easily adjusted.
WRITE FOR NEW CATALOG
The ALEXANDER MILBURN Co.
1436 W. Baltimore St.
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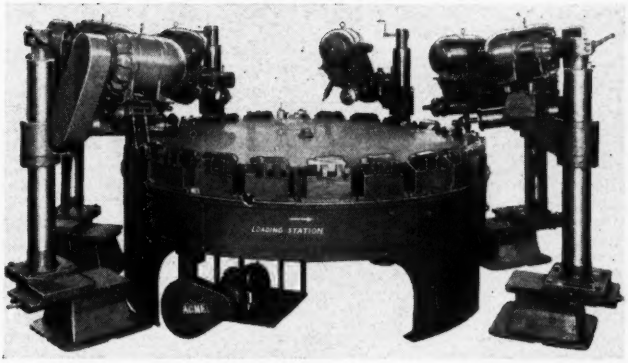
CHROMIUM PLATING
SCREWS — RIVETS — WASHERS — NUTS —
EYELETS — SMALL STAMPINGS — TURNINGS
— WIRE GOODS
ROLLED AND POLISHED FINISHES
Send Samples for Estimates
THE CHROMIUM PROCESS CO.
CENTER ST., DERBY, CONN.

is also obtained in still or mechanical plating. There is no need of making up a new nickel bath. One gallon of Lustrebright per 100 gallons can be added to the present nickel bath.

Lustrebright is guaranteed not to harm the plating solution and not cause the plate to peel or become brittle and produce streaky deposits even if used in excess. It is said to be inexpensive to maintain and simple to control. Lustrebright produces an ideal deposit of bright lustrous nickel that is an ideal base for chromium. Die castings can be successfully bright nickel plated previous to chromium by this process. It is, of course, necessary that a non-strike nickel solution for die castings be used with Lustrebright.

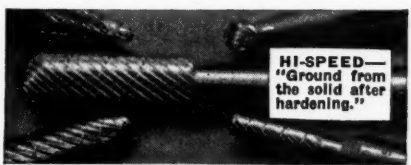


Acme Automatic Six Wheel Buffing Machine

Acme Automatic Six Wheel Buffing Machine

A practical and efficient automatic polishing and buffing machine has been placed on the market recently by Acme Manufacturing Company, 1641 Howard St., Detroit, Mich., The unit has been developed for buffing automotive body hardware, such as trunk hinges, door handles, regulator handles, brackets and other similar parts in the high production field.

The six wheel machine table is 8 ft. in diameter and is in constant rotation, regulation being made through a variable speed drive that can be adjusted merely by the turn of the hand wheel to obtain the maximum efficient speed. Each adjustable lathe is an individual



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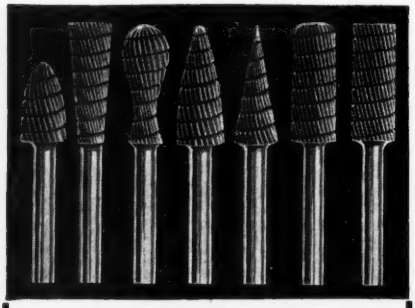
unit set up to the table and adjusted to the particular position and angle of contact desired.

The lathe head is equipped with a floating spindle which permits the buffing wheel to float over the work at an adjusted pressure. The float is obtained in any angle of the spindle from horizontal to vertical, resulting in correct pressure at the right angle on the work being finished. The float also greatly eliminates the number of wheel wear adjustments and reduces the wear of wheels and also of wheel compound. The main use is, however, to contact curved or irregular work which otherwise could not be readily finished.

The adjustable floating head lathes being complete units in themselves are said to be universal and can be used in conjunction with other types of holding and conveyor equipment. For general use they are usually equipped with a 5 or 7½ h.p. totally enclosed fan-cooled motor, V-belt drive for the particular spindle speed necessary. The table is driven with a fractional horse power drive. Other sizes of this same type of machine are built to take more or less heads, also with indexing stations and revolving spindles.

Trim for Outdoor Bulletins

A 40 ft. streamlined billboard which was recently erected at Chicago as plant identification for Joseph T. Ryerson & Son, Inc., 2558 W. 16th St., Chicago, Ill., employs the use of stainless steel. Besides generally dressing up the billboard, the gleaming silver of stainless steel is said to afford excellent opportunity for unusual and brilliant color contrast. The current color scheme of deep blue and orange is very effective.



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Ryerson Stainless Steel Sign

Stevens Nickel Buffing Compositions

Frederic B. Stevens Inc., 510 Third St., Detroit, Mich., has placed on the market three new nickel buffing compositions. These compositions are known as No. 601 Hi-Luster (White), No. 602 Hi-Luster (Pink), and No. 650 Fast Finish (White).

No. 601 Hi-Luster is an extra dry grade for producing a fine finish on such work as small die-cast parts and for a final wiping operation. No. 602 Hi-Luster is a medium dry grade that contains a percentage of a fine quality rouge. No. 650 Fast Finish is a medium

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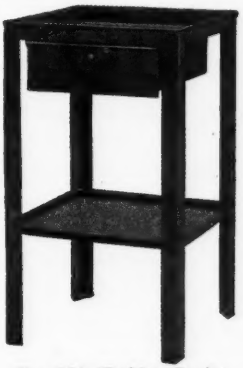

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dry grade that is said to be fast cutting. This grade is especially adaptable for buffing operations on hard, dense deposits and for coloring copper, brass, and so on.

All of these new nickel buffing compositions have proved their efficiency under operating conditions and are said to produce a clear, lustrous, and beautiful finish.

The practice of applying the buffing composition rather heavily to the wheel is said to be eliminated with the three new Stevens buffing compositions.

A feature of the nickel buffing compositions is the uniformity of each cake, of each grade, and of every shipment. Although a new method of manufacturing is employed, the uniformity of these new nickel buffing compositions is guaranteed by strict control in the laboratory and in the manufacturing process.

Boice-Crane Oscillating Spindle Sander

The Boice-Crane Company, 1726 Norwood Ave., Toledo, Ohio, is offering an Oscillating Spindle Sander and Grinder for wood and metal finishing.

This machine tool is recommended to pattern makers for sanding cores and any irregular edge work on either wood or metal patterns, also to cabinet makers and school shops and to industry having curved inside or outside edge grinding or finishing on metal parts. It is especially valuable in the metal working industries for grinding off

Boice-Crane Oscillating Spindle Sander

feather edges on alloy castings, for smoothing up irregularly shaped alloy and aluminum castings.

The oscillating spindle carries rubber drums of various diameters to which endless tube-like abrasive sleeves are mounted by merely expanding the rubber drums. The manufacturer carries a large assortment of these drums and

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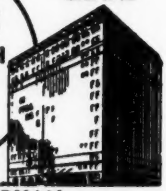
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Brooklyn, New York
Compositions

Buffs

sleeves from 1 to 3-in. diameter. Maximum clearance of drums above the tilting table is 6 inches.

A new design of gear drive was chosen for long wearing qualities and quiet operation. Belted motor drive from a 1750 r.p.m. motor develops a spindle speed of 2500 r.p.m. and 83 oscillations per minute. A unique feature claimed by the manufacturer is the ball bearing oscillating action requiring only occasional lubrication, and splash feed oiling to all other moving parts.

A two-way tilting work table measuring 20 in. square is tilted mechanically with crank and worm mechanism, with all angles indicated by an easy reading dial and pointer.

Duriron Bulletin

A new bulletin on steam jets, ejectors, tank outlets and spray nozzles has just been issued by The Duriron Company, 450 N. Findlay St., Dayton, Ohio. The bulletin is illustrated with photographs and dimension drawings of the equipment. Capacity tables are given where applicable.

A copyrighted chart simplifies the selection of the correct size jet for heating any volume of liquid, with steam pressures varying from 15 pounds to 85 pounds. The steam consumption in pounds per hour is automatically computed at the same time.

Also illustrated is a novel method of emptying lined tanks when piercing of the tank bottom for an outlet is to be avoided. The Duriron siphon is made to order to fit the tank and can be installed in old as well as new tanks.

Copies of the Duriron bulletin will be sent free on request.

Duriron Bulletin

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In CLEVELAND it's
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In JAMESTOWN, N. Y., it's
√ The Jamestown and
√ The SAMUELS

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